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Vuylsteke et al.

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(54) **SYSTEMS, METHODS AND APPARATUS FOR DISPENSING SHEETS OF MATERIAL**

(71) Applicant: **TRANZONIC COMPANIES**, Cleveland, OH (US)

(72) Inventors: **Kenneth F. Vuylsteke**, Rancho Santa Fe, CA (US); **Michael Duane Blanchard**, Knoxville, TN (US); **Atilla Rist**, Augsburg (DE); **Hans Van Reenen**, Den Hague (NL); **Fred I. Morad**, Toluca Lake, CA (US); **Robert A. Acosta**, Norwalk, CA (US)

(73) Assignee: **TRANZONIC COMPANIES**, Cleveland, OH (US)

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Related U.S. Application Data

(63) Continuation-in-part of application No. 15/313,495, filed as application No. PCT/US2016/031363 on May 6, 2016, now Pat. No. 10,149,583.

(30) **Foreign Application Priority Data**

May 12, 2015 (EP) 15001414

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A47K 17/00 (2006.01)
A47K 13/16 (2006.01)

(52) **U.S. Cl.**
CPC ***A47K 17/003*** (2013.01); ***A47K 13/165*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

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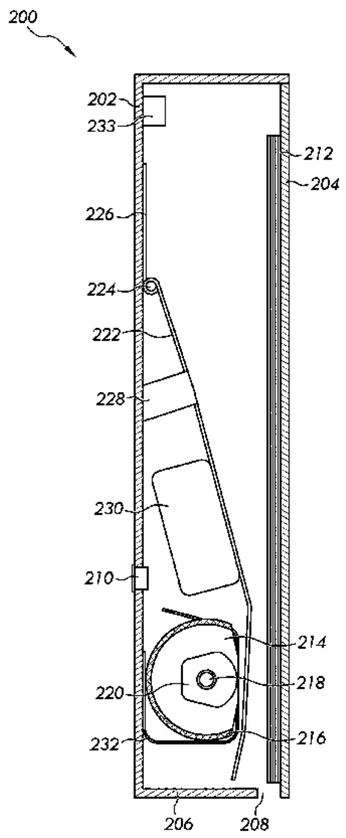
Primary Examiner — Gene O Crawford
Assistant Examiner — Ayodeji T Ojofeitimi
(74) *Attorney, Agent, or Firm* — Taft Stettinius & Hollister LLP; Ryan O. White; Daniel J. Krieger

(57) **ABSTRACT**

A sheet dispensing apparatus for dispensing sheets from a sheet material card having a plurality of sheets. The sheet dispensing apparatus includes a sensor, a motor including a motor shaft, a supply roller operatively connected to the motor, an indicator, and a controller operatively connected to the proximity sensor and to the indicator. The controller includes a processor and a memory configured to store program instructions. The processor is configured to execute the stored program instructions to: detect a first presence of an object with the sensor; move the supply roller into contact with one sheet of the plurality of sheets in response to the detecting the first presence of the object; rotate the motor shaft a first time to move the supply roller a predetermined angle of rotation to dispense the one sheet; and stop the motor shaft when the predetermined angle of rotation has been completed.

17 Claims, 21 Drawing Sheets



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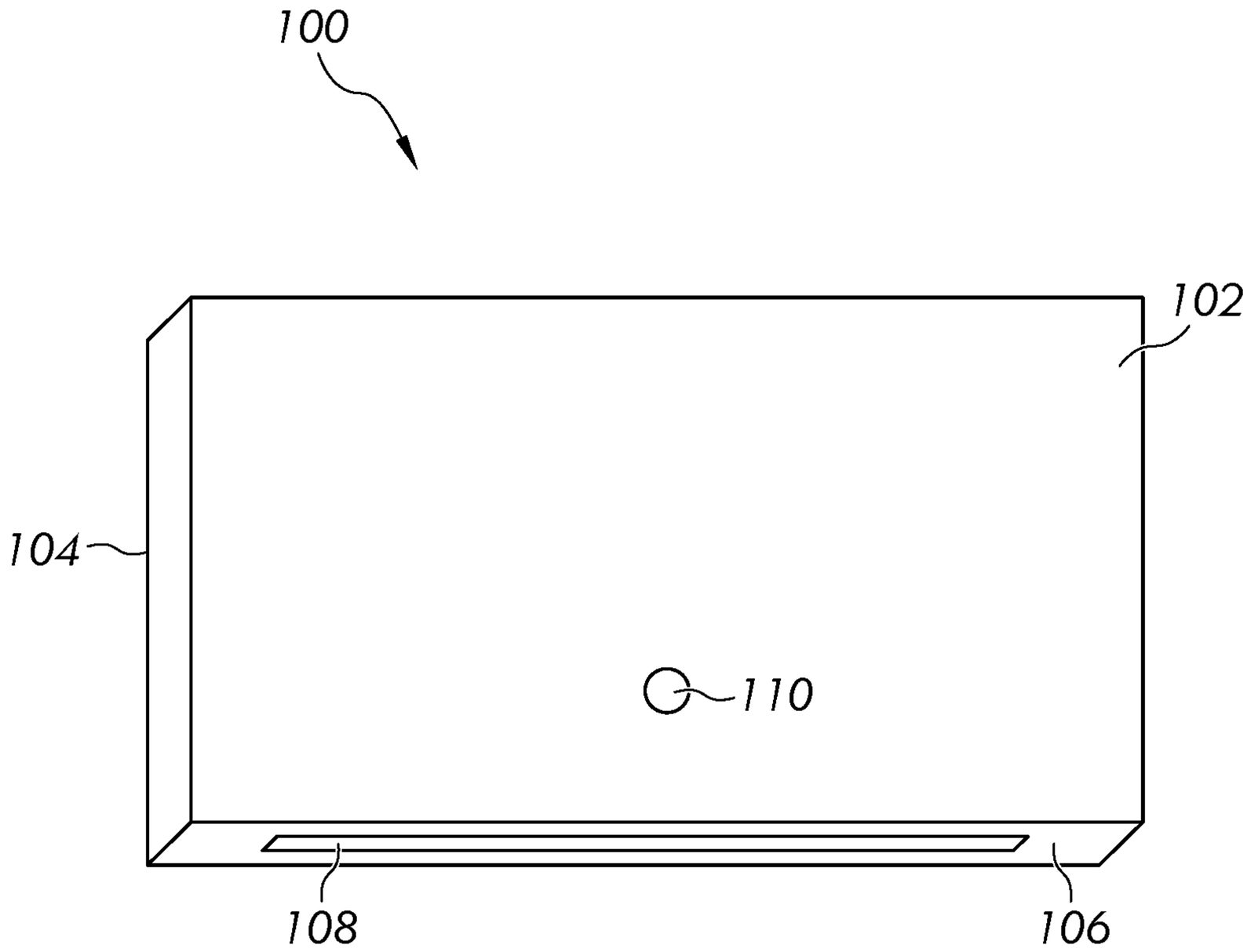

FIG. 1

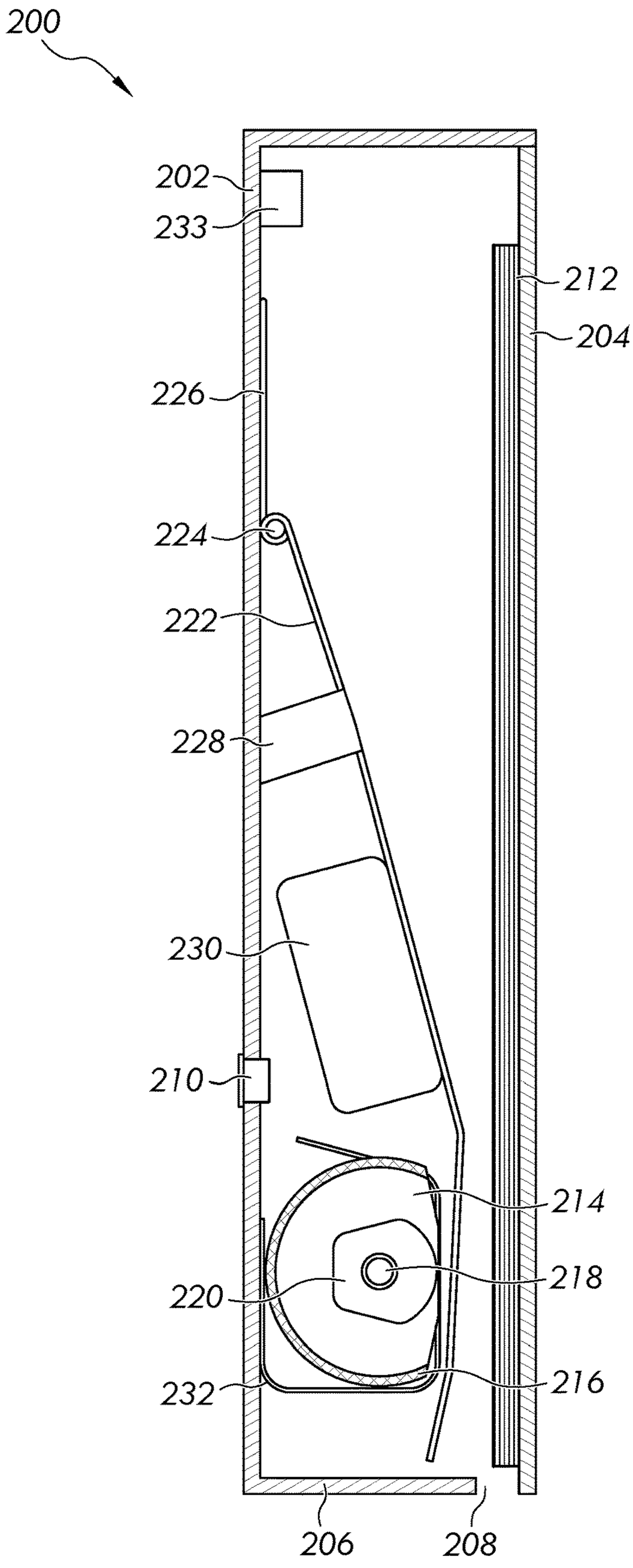
200
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FIG. 2A

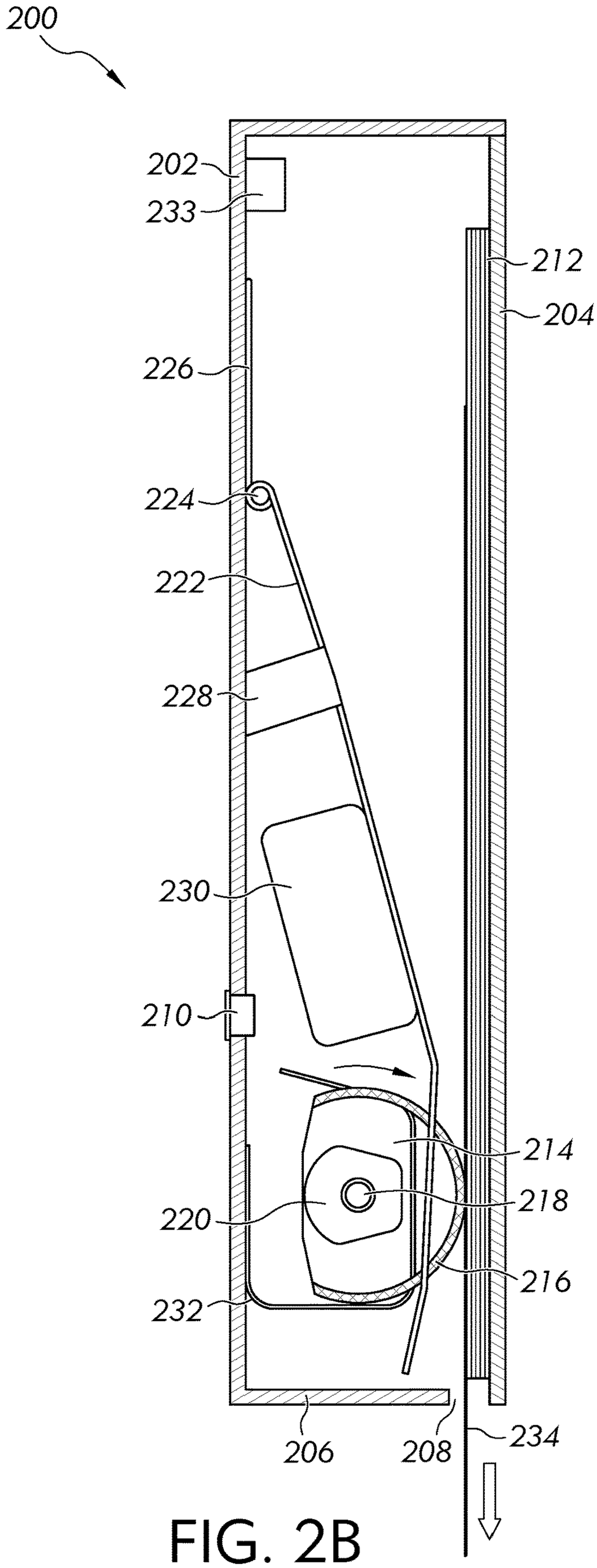
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FIG. 2B

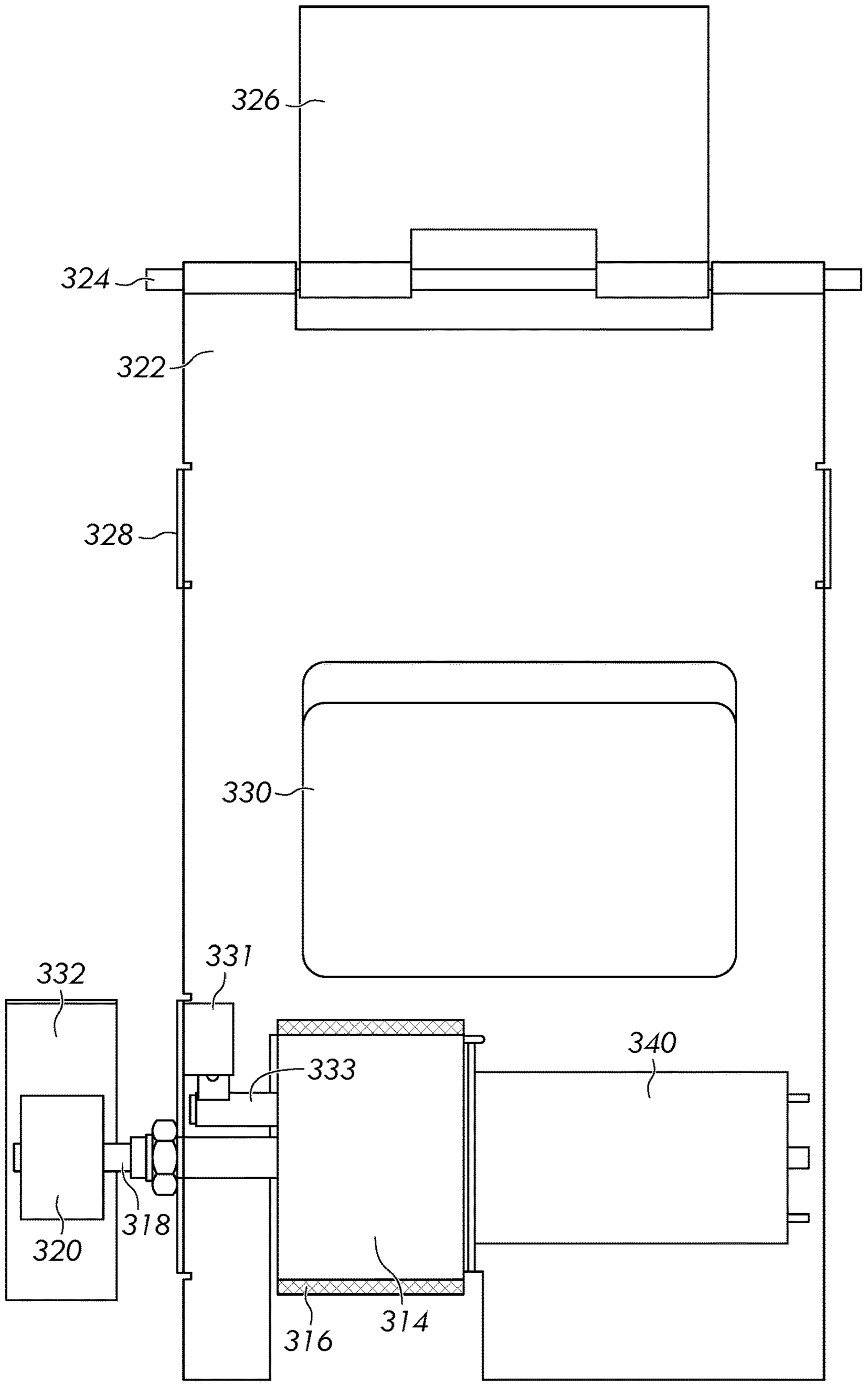


FIG. 3

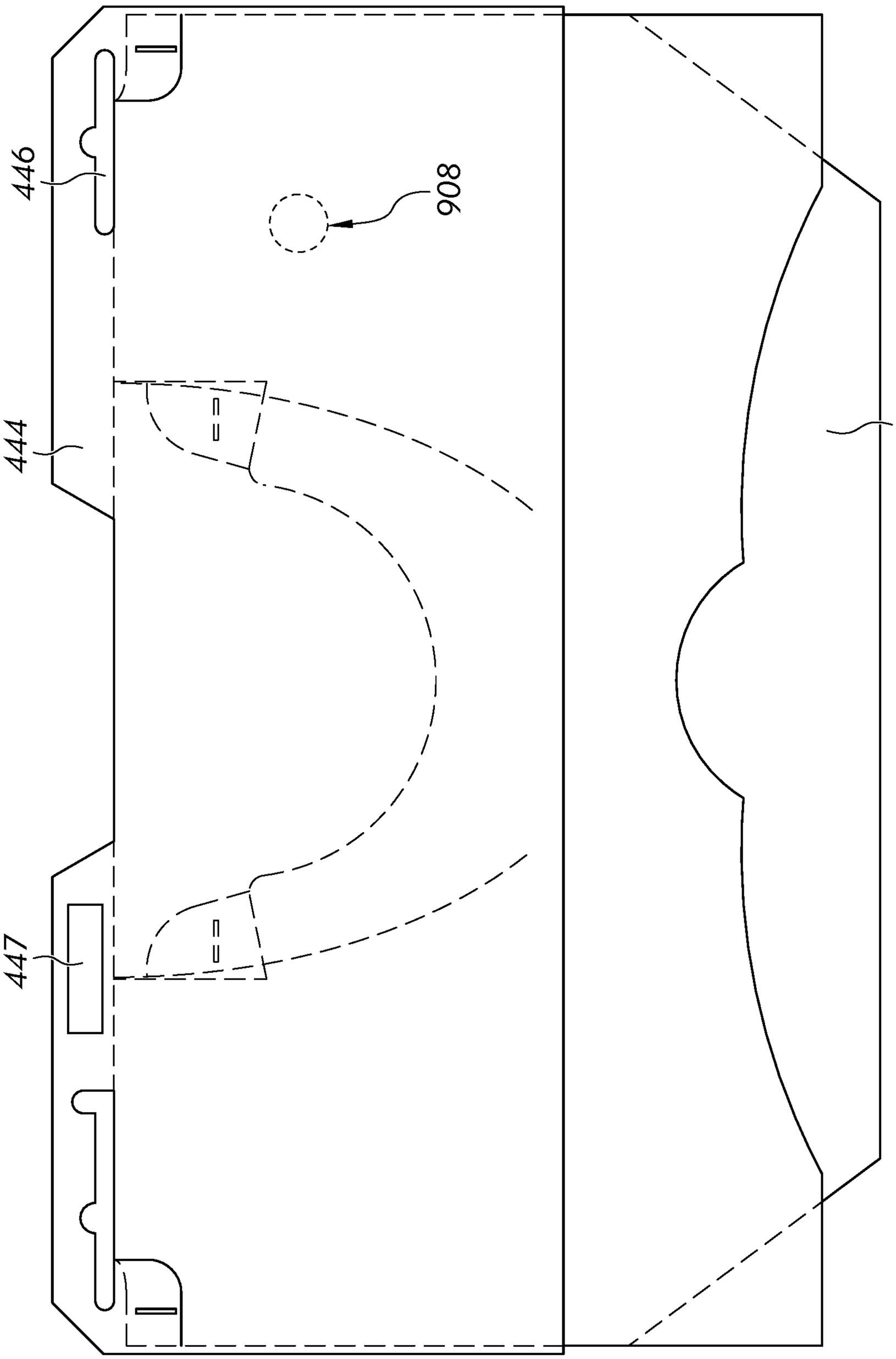


FIG. 4

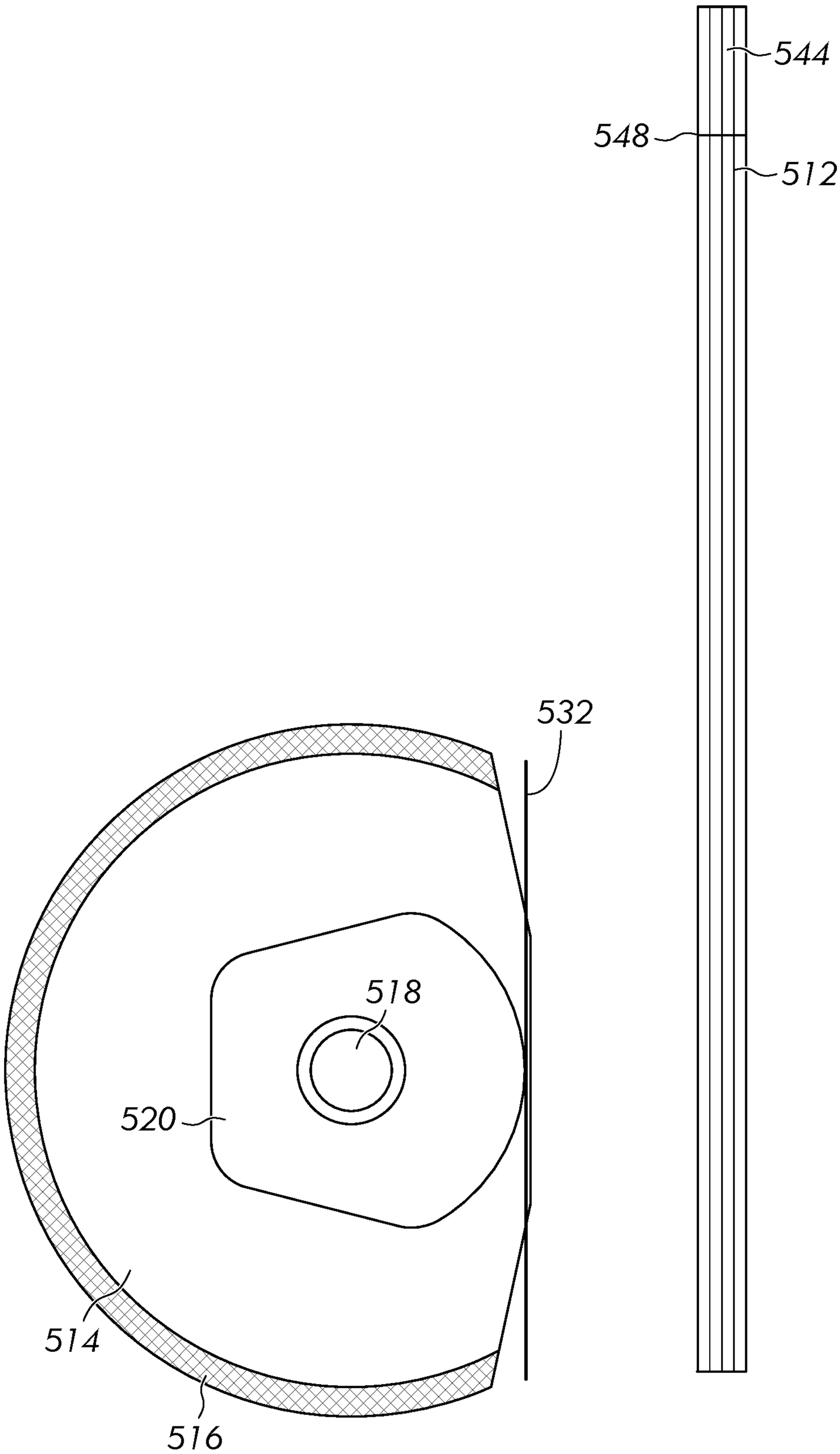


FIG. 5A

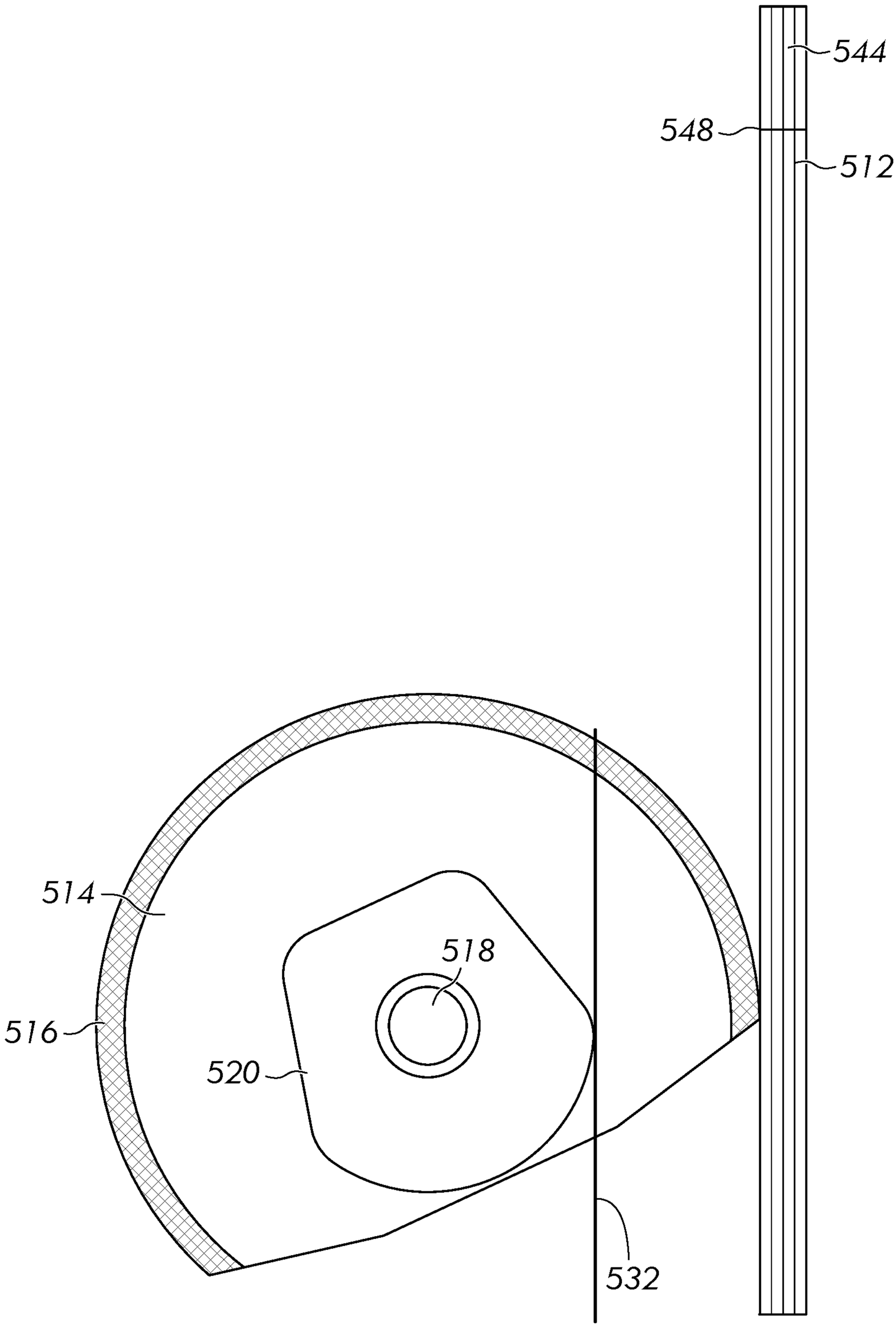


FIG. 5B

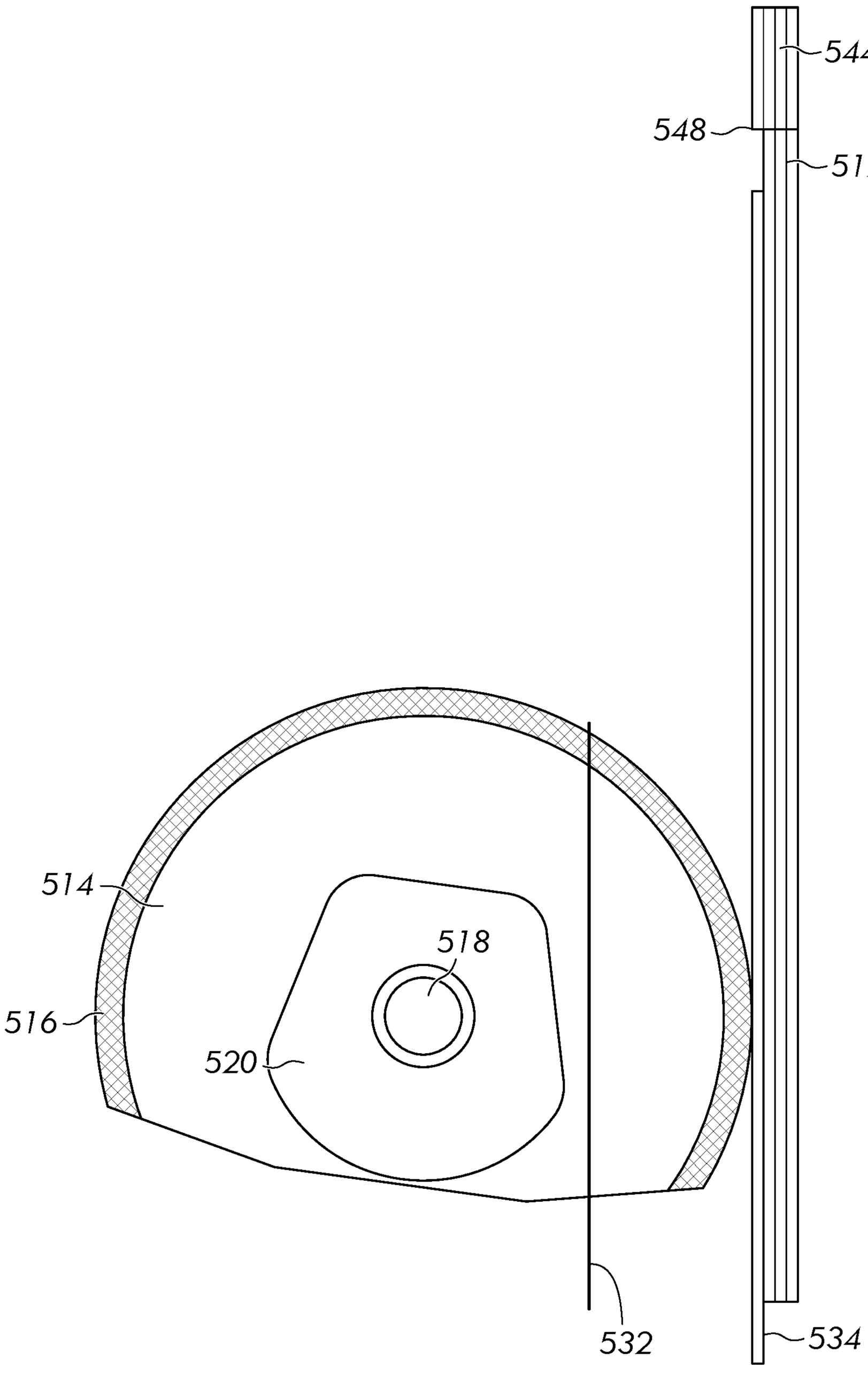


FIG. 5C

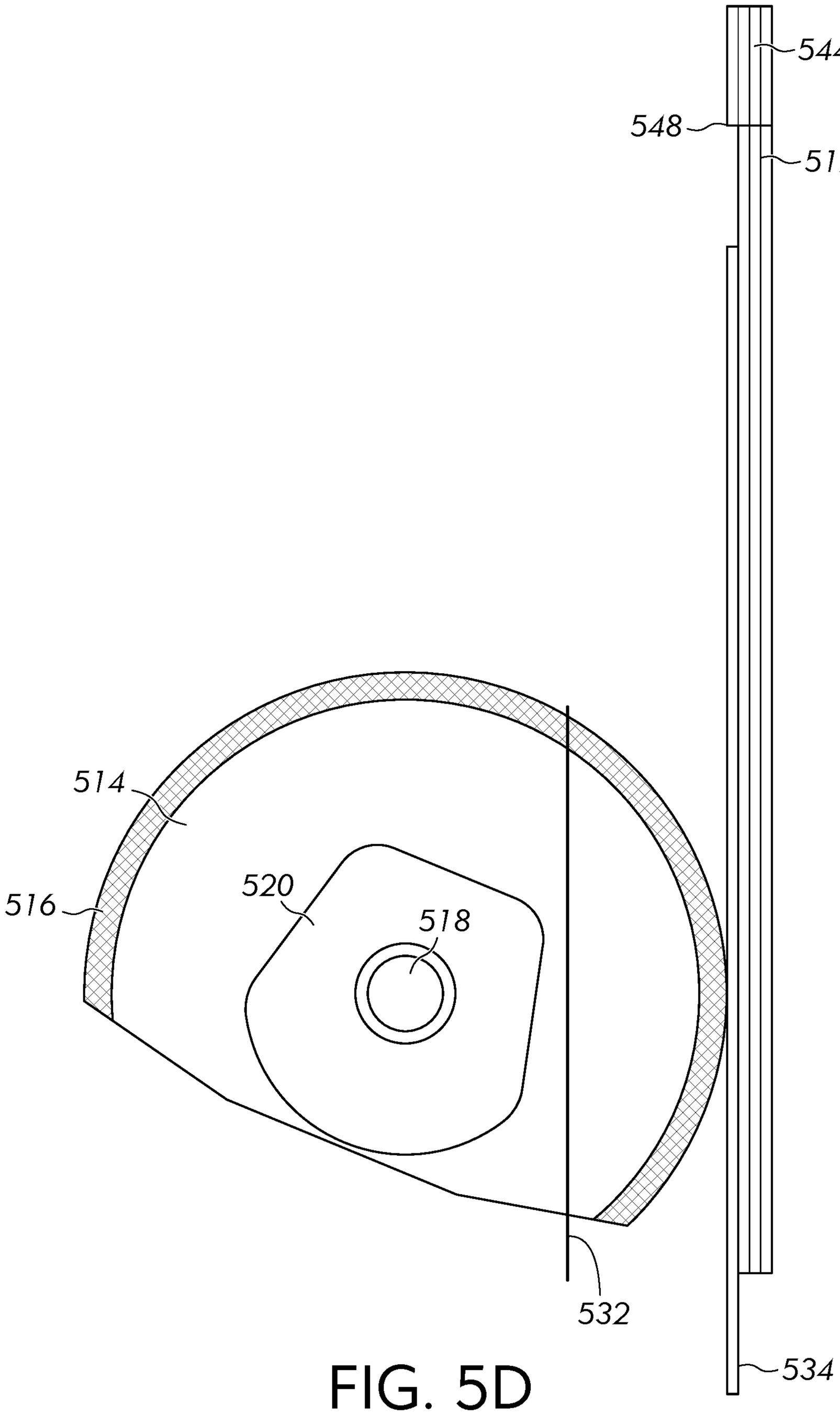


FIG. 5D

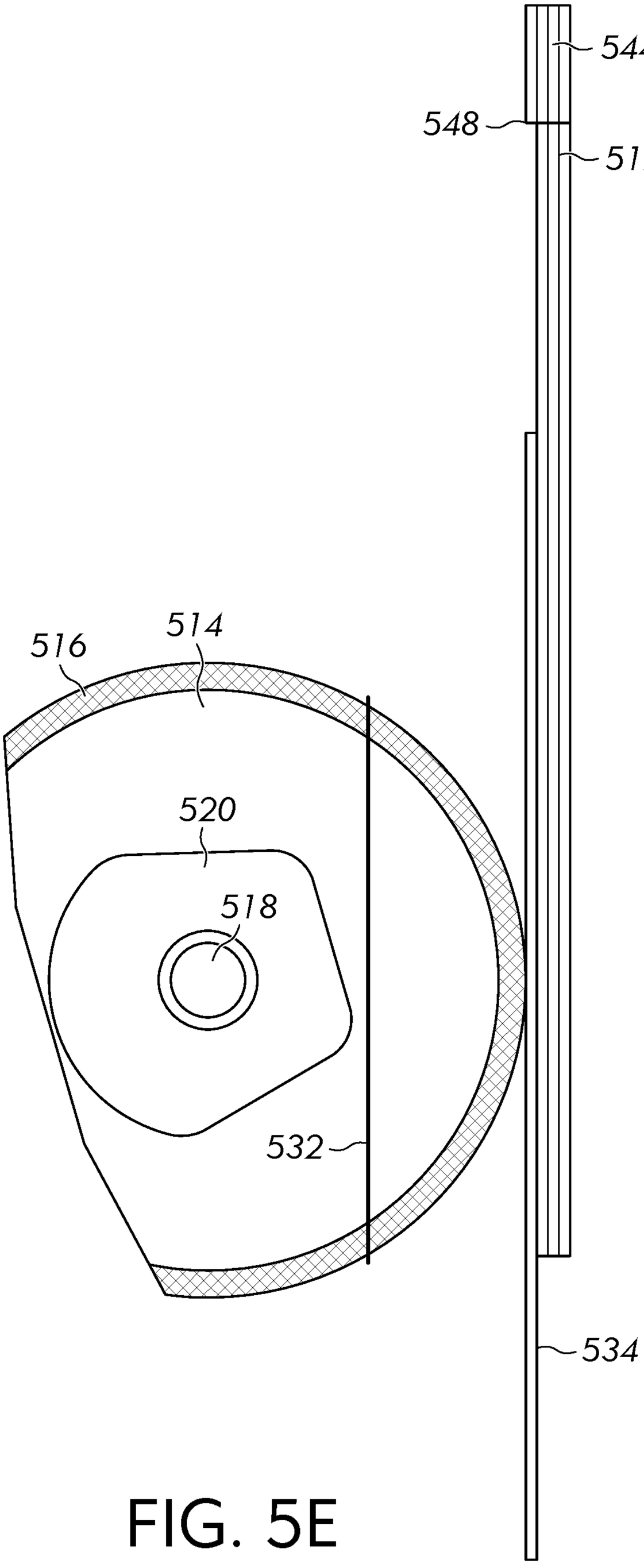


FIG. 5E

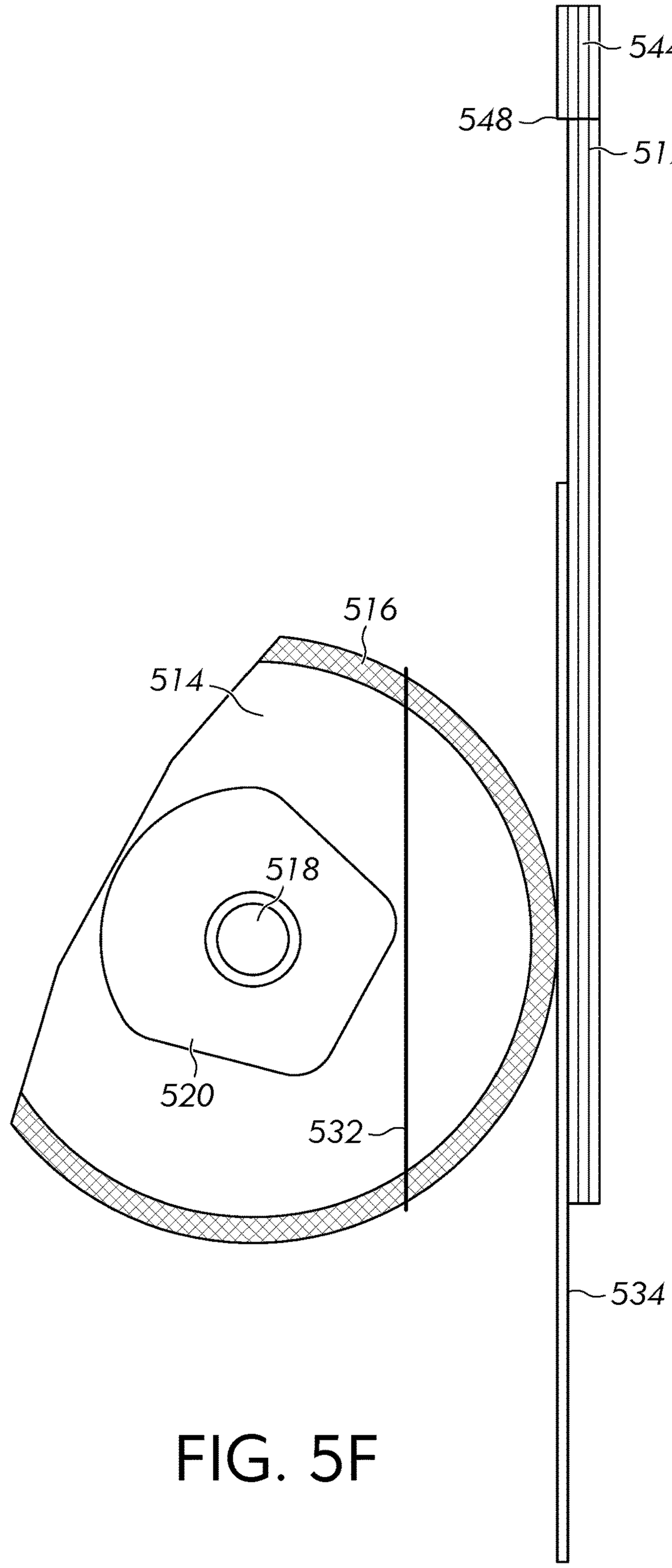


FIG. 5F

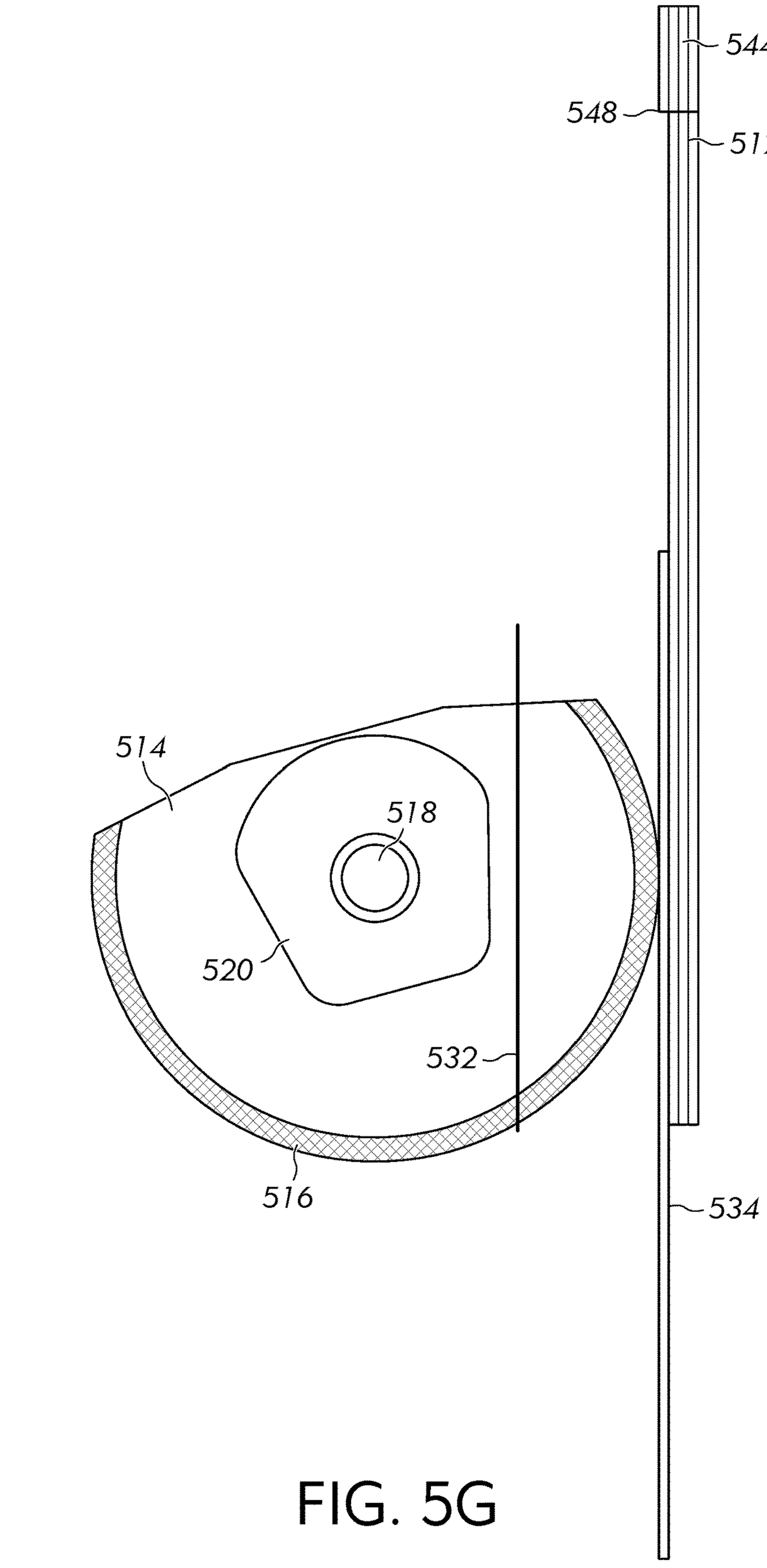


FIG. 5G

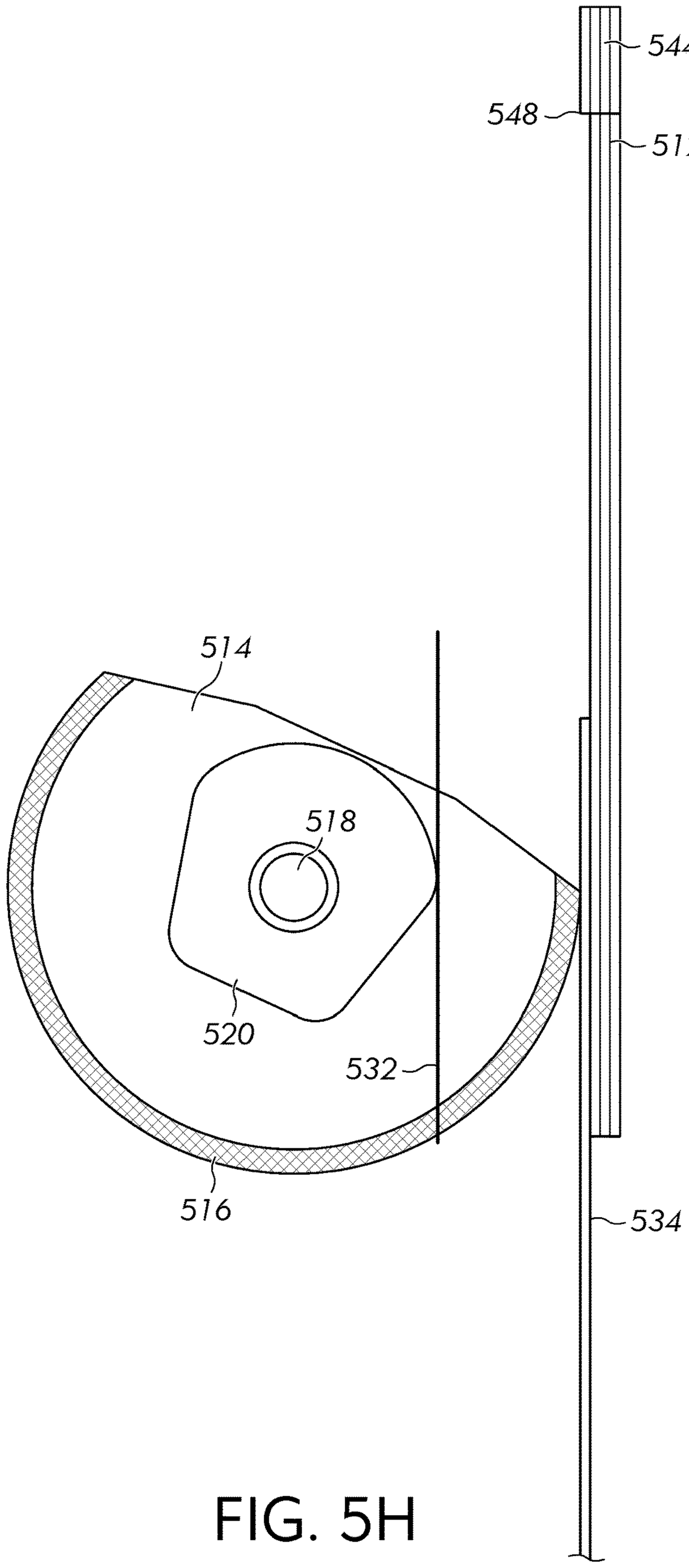


FIG. 5H

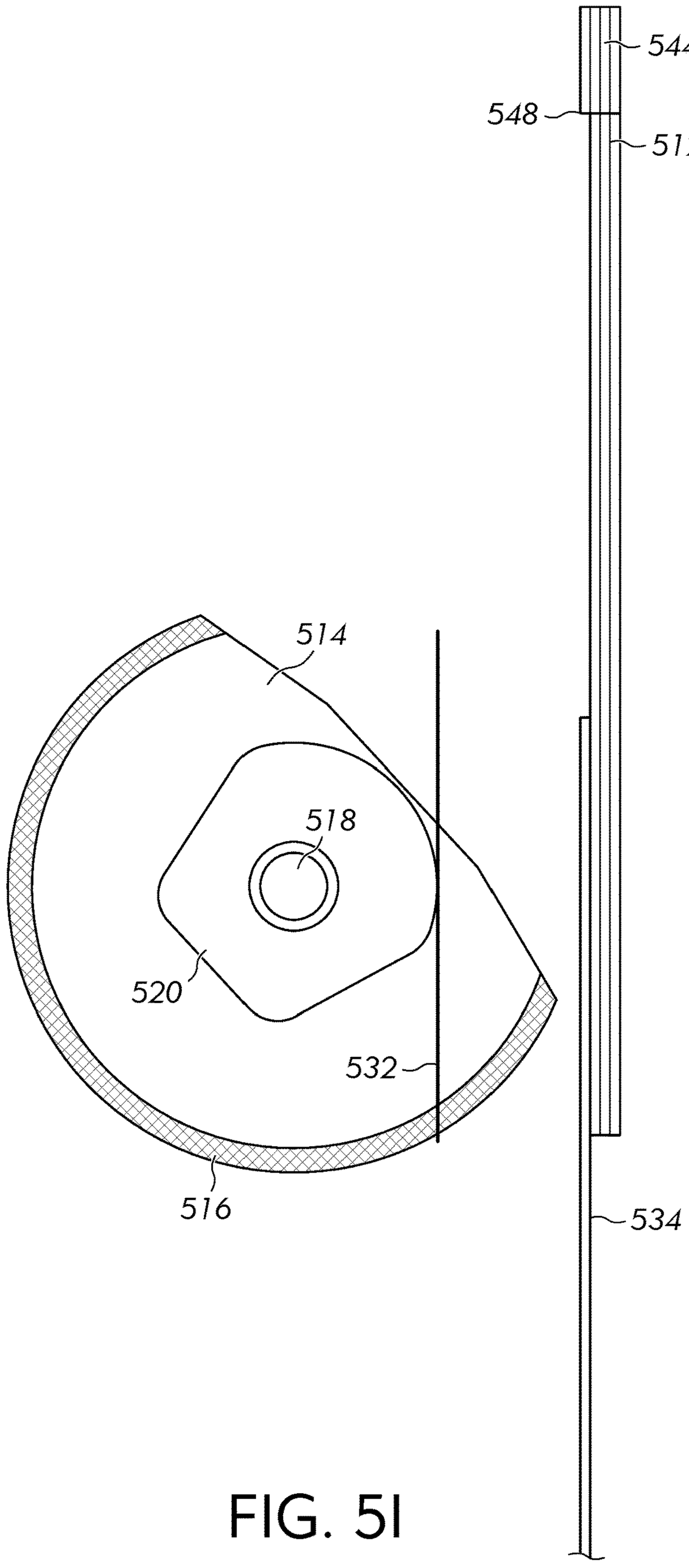


FIG. 5I

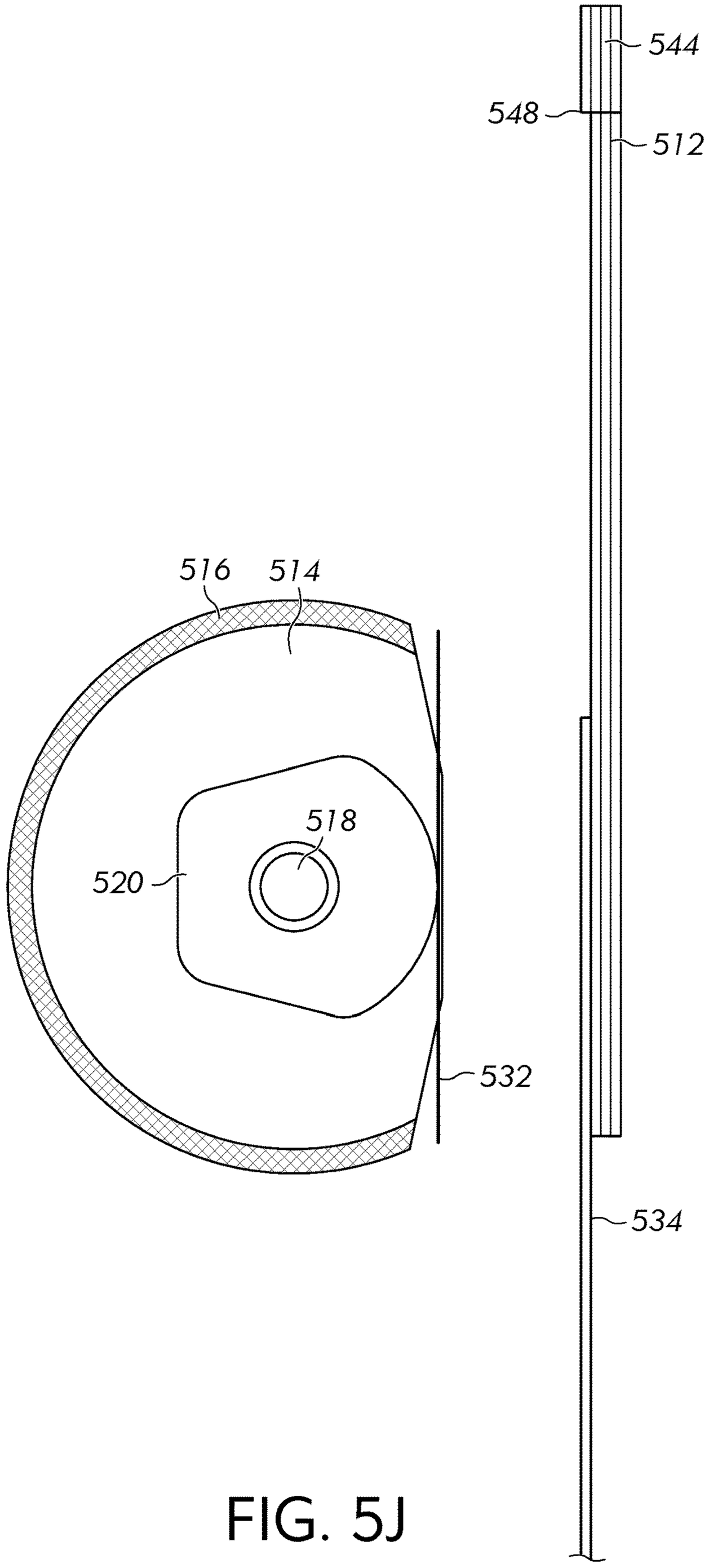


FIG. 5J

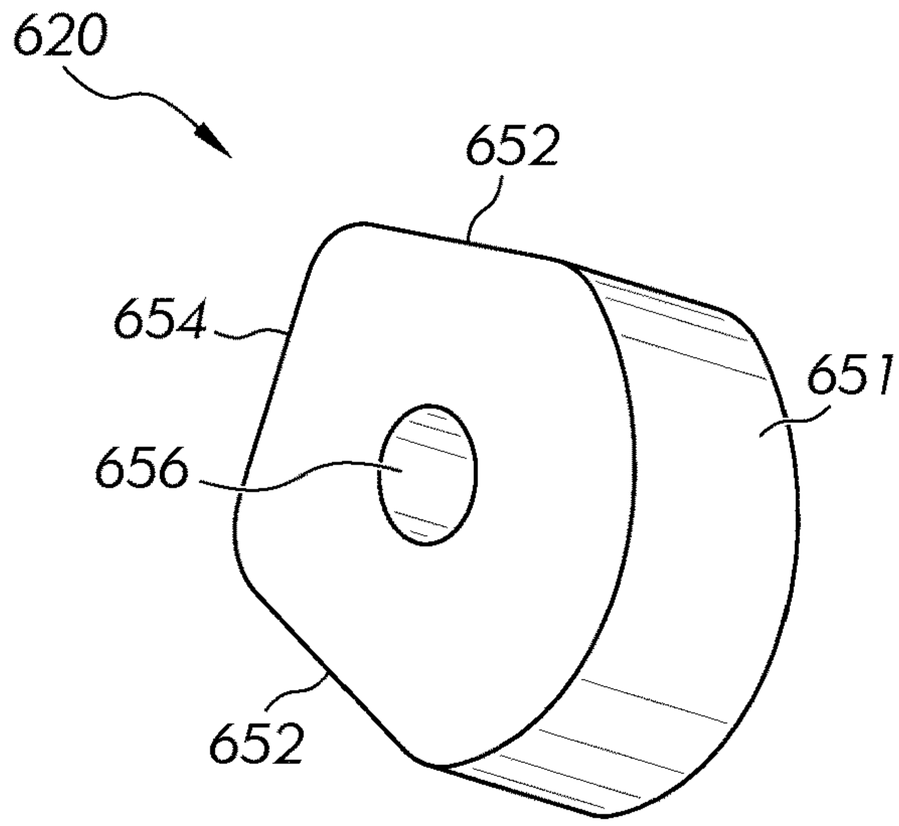


FIG. 6

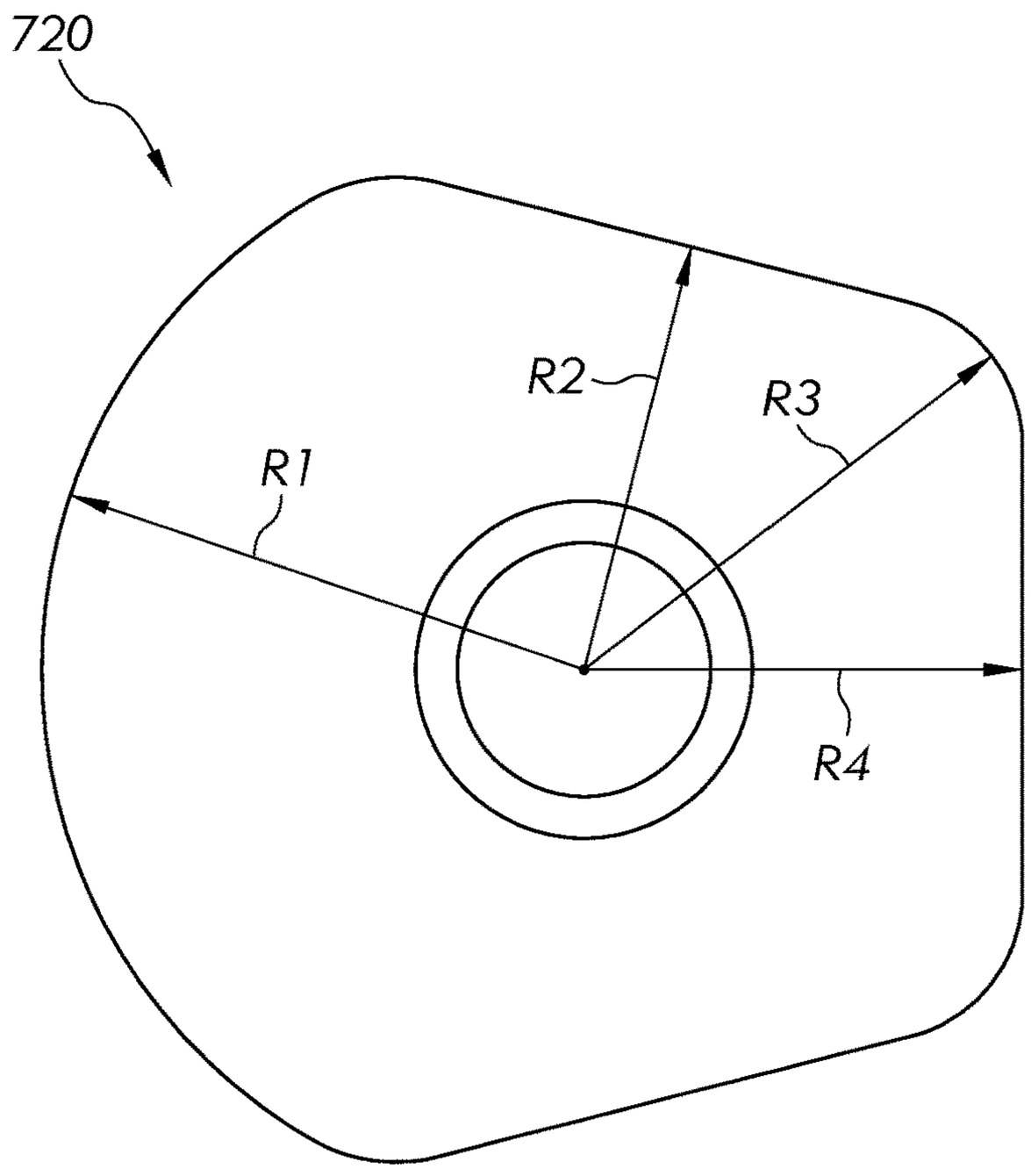


FIG. 7

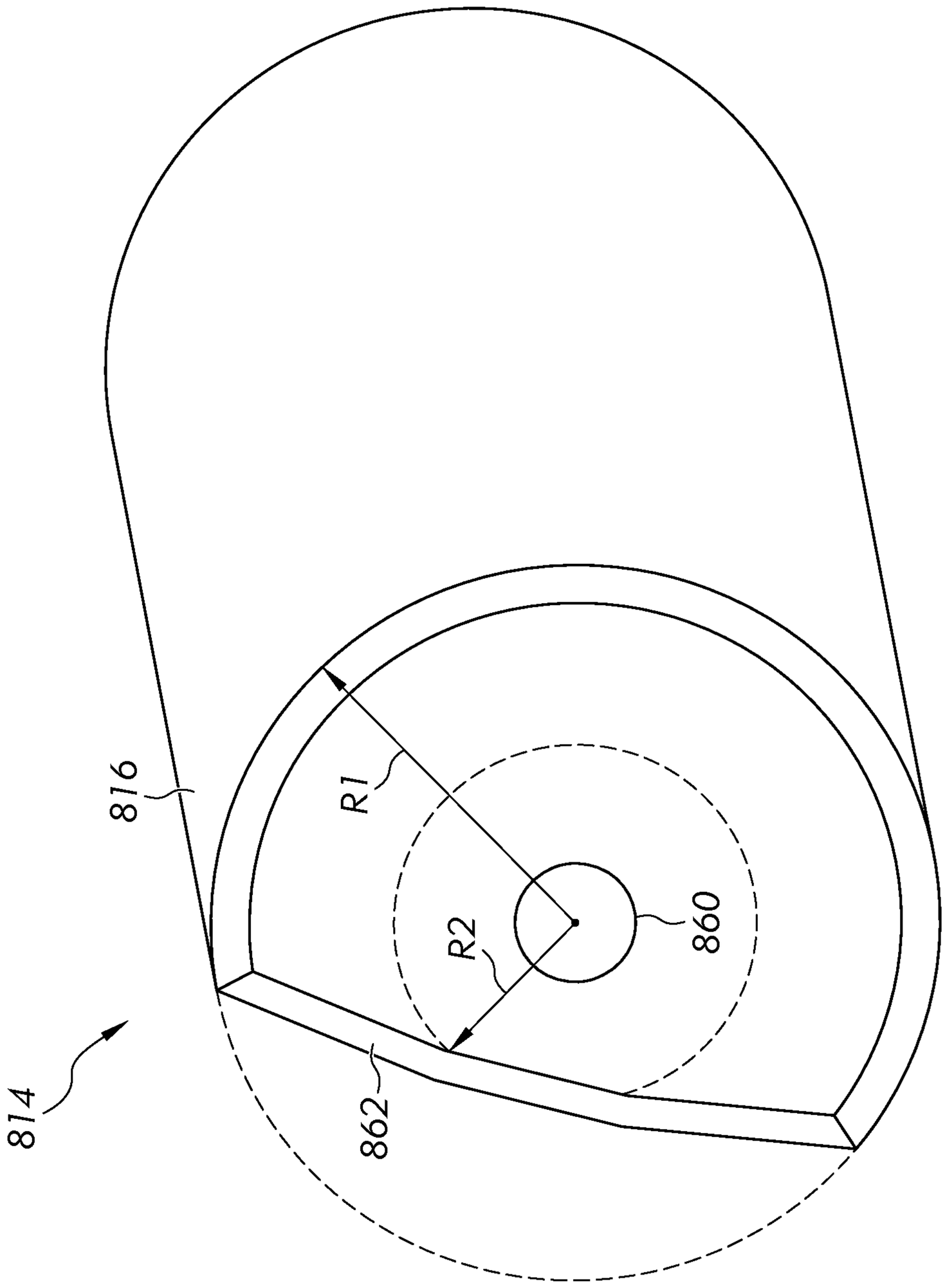


FIG. 8

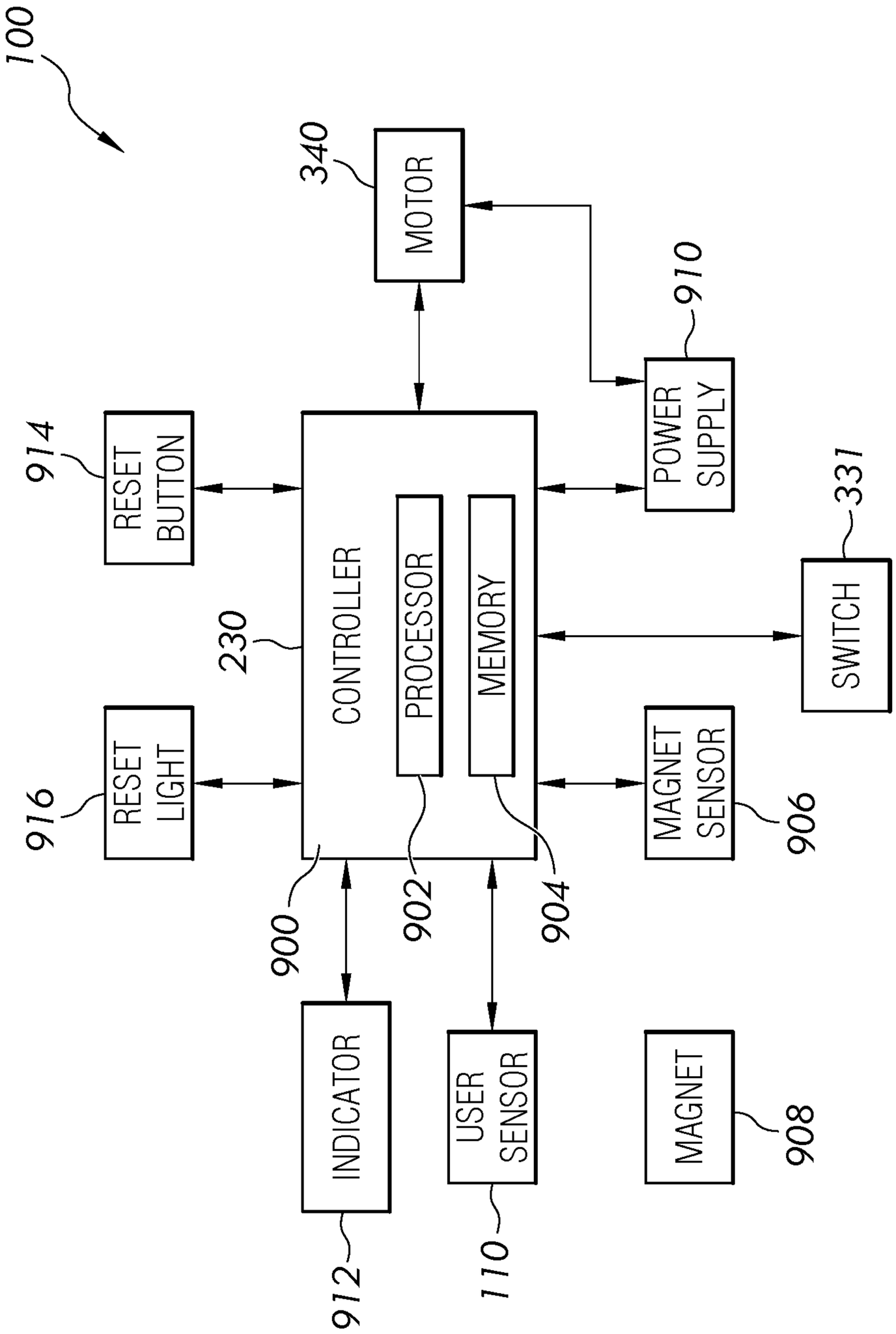

100
340
MOTOR
910
POWER SUPPLY
914
RESET BUTTON
230
CONTROLLER
PROCESSOR
MEMORY
331
SWITCH
916
RESET LIGHT
MAGNET SENSOR
906
900
902
904
INDICATOR
USER SENSOR
MAGNET
908
912
110

FIG. 9

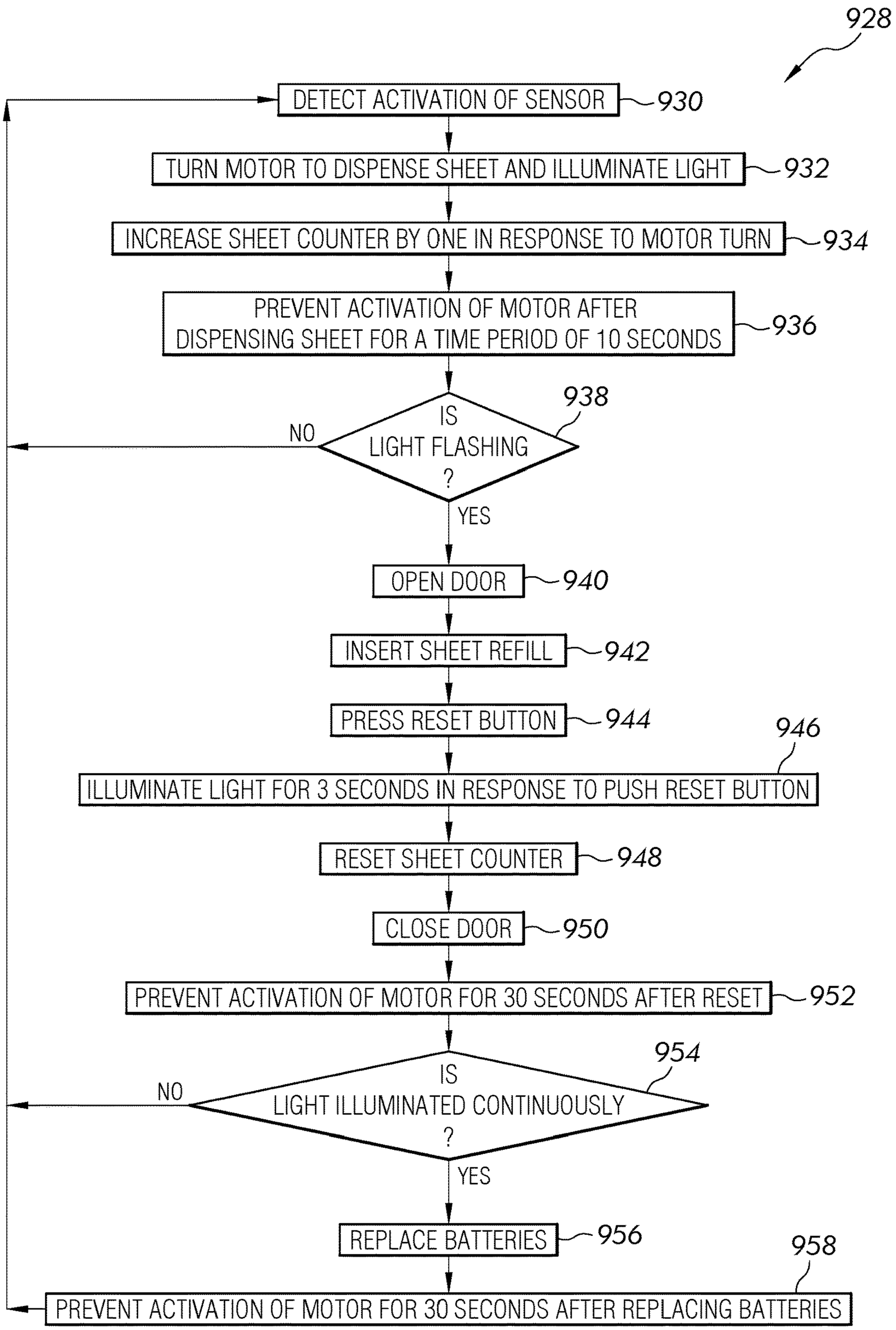

928
DETECT ACTIVATION OF SENSOR
930
TURN MOTOR TO DISPENSE SHEET AND ILLUMINATE LIGHT
932
INCREASE SHEET COUNTER BY ONE IN RESPONSE TO MOTOR TURN
934
PREVENT ACTIVATION OF MOTOR AFTER DISPENSING SHEET FOR A TIME PERIOD OF 10 SECONDS
936
IS LIGHT FLASHING ?
938
NO
YES
OPEN DOOR
940
INSERT SHEET REFILL
942
PRESS RESET BUTTON
944
ILLUMINATE LIGHT FOR 3 SECONDS IN RESPONSE TO PUSH RESET BUTTON
946
RESET SHEET COUNTER
948
CLOSE DOOR
950
PREVENT ACTIVATION OF MOTOR FOR 30 SECONDS AFTER RESET
952
IS LIGHT ILLUMINATED CONTINUOUSLY ?
954
NO
YES
REPLACE BATTERIES
956
PREVENT ACTIVATION OF MOTOR FOR 30 SECONDS AFTER REPLACING BATTERIES
958

FIG. 10

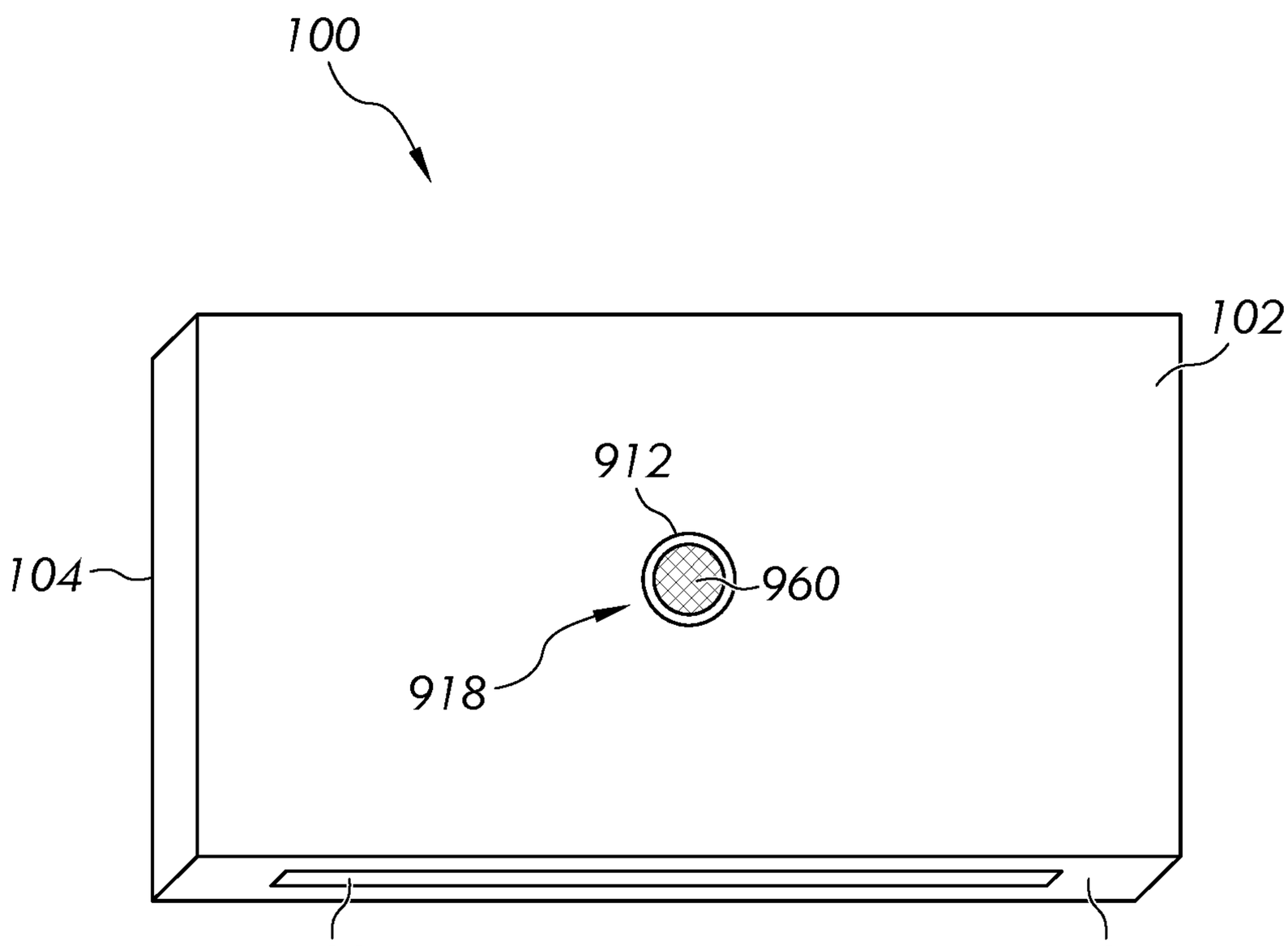
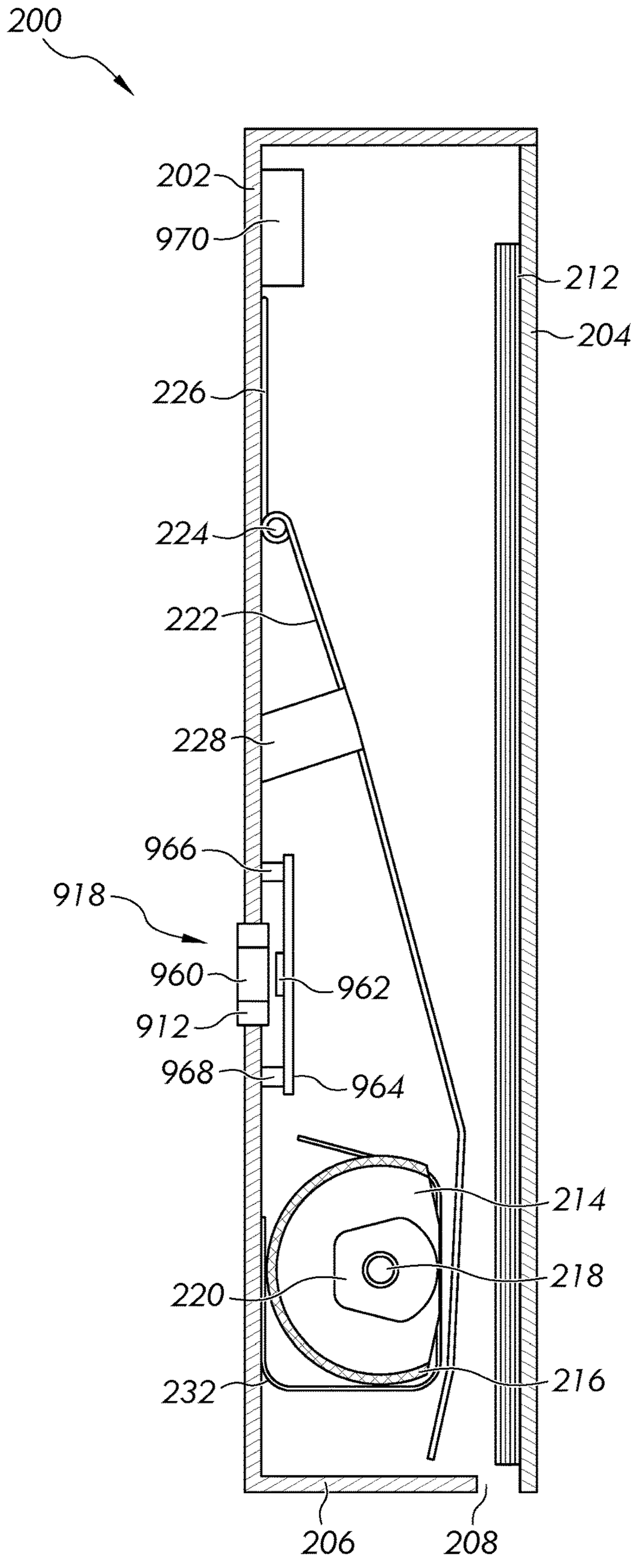


FIG. 11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208

FIG. 12

SYSTEMS, METHODS AND APPARATUS FOR DISPENSING SHEETS OF MATERIAL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part application of U.S. patent application Ser. No. 15/313,495, having the title SYSTEMS, METHODS, AND APPARATUSES FOR DISPENSING SHEETS OF MATERIAL, filed Nov. 22, 2016, and which claims priority to European Patent Application No. 15001414.0, filed on May 12, 2015, both of which are incorporated by reference herein in their entirety.

FIELD OF THE DISCLOSURE

The present invention relates to a machine that dispenses a product, and more particularly to a sheet dispensing machine that dispenses a sheet of material from a stack of materials.

BACKGROUND

Reliably dispensing sheets of material, including for example paper products from a stack of joined paper products, is often difficult. For example, the stack of material sheets may be joined at one end in a manner such that the application of an appropriate force upon a single sheet will cause it to separate from the remainder of material sheets. In many dispensers of such materials, a mechanical arm may contact the outermost sheet in the stack and tear it away from the remainder of the stack. However, the mechanical arm often contacts the sheet material in a very small area relative to the area of the sheet material itself. As a result, where the material sheets do not have great tensile strength, the sheets are prone to tearing during dispensing. Additionally, the mechanical arm may not disengage the outermost sheet after the outermost sheet is torn away from the remainder of the stack, causing difficulty in the ultimate removal of the sheet material from the dispenser. One such example of the dispensing of material sheets is in the use of thin material sheets used to provide a sanitary barrier between a user of a device and the device, including for example, toilet seat covers.

What is needed is a more reliable system, method, and apparatus for dispensing sheets of material. The present application appreciates that providing such a system, method, and apparatus may be a challenging endeavor.

SUMMARY

In one embodiment, there is provided a method for dispensing with a sheet dispenser a sheet from a plurality of sheets. The method includes: detecting a plurality of object sensing events with an object sensor; for each object sensing event, moving a supply roller into contact with a sheet of the plurality of sheets and rotating a motor shaft to dispense the sheet with the supply roller; for each rotation of the motor shaft, updating a value stored in a counter to indicate the number of sheets being dispensed from the plurality of sheets; comparing the stored value to a predetermined value; and illuminating a light to emit a pattern when the stored number reaches the predetermined value, wherein the light illumination provides an indication that the sheet dispenser requires additional sheets for dispensing.

In another embodiment, there is provided a sheet dispensing apparatus including a wall configured to support a sheet material card having a plurality sheets. The apparatus includes an object sensor configured to dispense a sheet from the sheet material card in response to activation by a user and a supply roller connected to a shaft. The supply roller includes a radiused portion and at least one truncated portion. A retracting roller is connected to a shaft, wherein the retracting roller has a radiused portion, and at least one truncated portion. A supporting plate is engaged and disengaged by the retracting roller during rotation of the shaft. The radiused portion of the supply roller is directed in a first direction and the radiused portion of the retracting roller is directed in a second direction, wherein the first direction is different from the second direction. The object sensor is operatively connected to the shaft through a processor and activates disengagement of the retracting roller from the supporting plate and activates the supply roller to translate toward the wall of the sheet dispensing apparatus for dispensing a sheet from the sheet material card.

In a further embodiment, there is provided a sheet dispensing apparatus including a wall configured to support a sheet material card having a plurality sheets. The apparatus includes a sensor, a motor including a motor shaft, a supply roller operatively connected to the motor, an indicator, and a controller operatively connected to the sensor and to the indicator. The controller includes a processor and a memory configured to store program instructions. The processor is configured to execute the stored program instructions to: detect a first presence of an object with the sensor; move the supply roller into contact with one sheet of the plurality of sheets in response to the detecting the first presence of the object; rotate the motor shaft a first time to move the supply roller a predetermined angle of rotation to dispense the one sheet; and stop the motor shaft when the predetermined angle of rotation has been completed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying figures, which are incorporated in and constitute a part of the specification, illustrate various example apparatuses, systems, and methods, and are used merely to illustrate various example embodiments.

FIG. **1** illustrates a perspective view of an example arrangement of a dispensing apparatus **100**.

FIG. **2**A illustrates a sectional view of an example arrangement of a dispensing apparatus **200**.

FIG. **2**B illustrates a sectional view of an example arrangement of dispensing apparatus **200**.

FIG. **3** illustrates an elevational view of an example arrangement of a dispensing apparatus.

FIG. **4** illustrates an elevational view of an example arrangement of a sheet material card containing multiple sheets **412**.

FIG. **5**A illustrates an example arrangement of a retracting roller **520**, a sheet supply roller **514**, and a sheet material **512**.

FIG. **5**B illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **5**C illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **5**D illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **5**E illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **5**F illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **5**G illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **5**H illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **5**I illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **5**J illustrates an example arrangement of retracting roller **520**, sheet supply roller **514**, and sheet material **512**.

FIG. **6** illustrates a perspective view of a retracting roller **620**.

FIG. **7** illustrates an elevational view of a retracting roller **720**.

FIG. **8** illustrates a perspective view of a sheet supply roller **814**.

FIG. **9** illustrates a block diagram of the sheet dispenser apparatus.

FIG. **10** is a flow diagram illustrating one or more operating procedures of a sheet dispensing apparatus.

FIG. **11** illustrates a perspective view of an example arrangement of a dispensing apparatus.

FIG. **12** illustrates a sectional view of an example arrangement of a dispensing apparatus.

DETAILED DESCRIPTION

Sheet material dispensers, such as that disclosed in European Patent Application Publication No. EP2522265 (A1), may utilize feed rollers in order to advance a sheet material from a sheet material storage device, such as a card of sheet products. The sheet material may be attached in a stack to the card (which may include a substrate configured to be attached to the interior of the dispenser) via a perforated, or otherwise limited, connection, such that the application of a force pulling the sheet material away from the card may cause it to separate at predesignated points. A single layer of sheet material may be accordingly advanced out of the dispenser so as to permit manipulation of the sheet material by a user, including allowing a user to grasp the sheet material and remove it completely from the dispenser. European Patent Application Publication No. EP2522265 (A1) is incorporated by reference herein in its entirety.

In one embodiment, the various dispensing apparatuses disclosed herein may be used for a specific purpose, including for example, the dispensing of thin paper toilet seat covers. The toilet seat covers may be contained and/or dispensed in a substantially flat state. The toilet seat covers may be contained and/or dispensed in a substantially folded state, so as to reduce the necessary size of the dispensing apparatus. However, it is understood that the various dispensing apparatuses disclosed herein may be used to dispense any of a variety of sheet materials from an internal storage area, including for example: a paper, a cardboard, a polymer, a metal, an alloy, an organic material, a textile, and the like. Further, it is understood that the various dispensing apparatuses disclosed herein may be used to dispense any sheet material contained on a card of sheet products.

In one embodiment, the various dispensing apparatuses disclosed herein may be used to dispense a perforated towel. In one embodiment, the various dispensing apparatuses disclosed herein may be used to dispense at least one of a flat fold towel, a soft fold towel, an inter-fold towel, a continuous roll towel, and a perforated roll towel.

FIG. **1** illustrates an example arrangement of a dispensing apparatus **100**. Apparatus **100** may include a cover **102**, a rear wall **104**, at least one side wall **106**, and a dispensing port **108**. Apparatus **100** may be formed from any of a variety of materials, including for example: a polymer, a metal, an alloy, an organic material, and the like. Apparatus **100** may include any of a variety of shapes necessary to store and dispense sheet materials.

Apparatus **100** may include at least one sensor **110**. At least one sensor **110** may include any of a variety of sensors configured to activate apparatus **100** to cause at least one article of sheet material to be dispensed. Sensor **110** may be operatively connected to at least one of a printed circuit board, a power source, and a power supply.

In one embodiment, sensor **110** is a capacitive sensor configured to sense the presence of a user's body part, such as the user's hand, in the proximity of apparatus **100**. The capacitive sensor may relay the sensing of the proximity of a user's hand to a printed circuit board (not shown), which may cause an electric motor (not shown) to rotate a supply roller (not shown), which may cause a single article of a sheet material to be dispensed from apparatus **100**. Sensor **110** may be a capacitive sensor oriented within apparatus **100**, rather than on cover **102**. That is, no sensor may be present on cover **102** in one embodiment, but rather the sensor may be contained within apparatus **100**.

In another embodiment, sensor **110** is an infrared sensor. Sensor **110** may be a passive infrared sensor. Sensor **110** may sense motion. Sensor **110** may sense motion of a user near apparatus **100**. Sensor **110** may sense motion of a user's hand waved near apparatus **100**, thus indicating that the user requests the dispensing of at least one article of a sheet material from apparatus **100**.

Sensor **110** may include a light sensor configured to sense lights activated near apparatus **100**, such that the activation of lights near apparatus **100** causes apparatus **100** to dispense an article of a sheet material. Sensor **110** may be a touch sensor, such that a user physically touches sensor **110** when the user desires the dispensing of a sheet material from apparatus **100**. Sensor **110** may include a microphone, and may sense noise caused by a user, which may cause apparatus **100** to automatically dispense a sheet material from apparatus **100** in anticipation of a user desiring an article of sheet material. Sensor **110** may include a microphone configured to permit voice recognition capabilities, such that a user may speak a specific word or term to cause the dispensing of a sheet material from apparatus **100**. Sensor **110** may sense temperature, such as the body heat of a user present near apparatus **100**, and may dispense an article of sheet material in anticipation of a user desiring an article of sheet material. Sensor **110** may include an RFID reader configured to sense the presence of a tag in the possession of a user, such that an article of sheet material is only dispensed to specific users. Sensor **110** may include a shock sensor configured to sense a user moving near apparatus **100**, touching apparatus **100**, tapping on apparatus **100** with an object or body part, or the like, after which apparatus **100** may dispense an article of a sheet material.

Sensor **110** may be in communication with an external surface of apparatus **100**. Sensor **110** may be contained completely internally within apparatus **100**.

In one embodiment, apparatus **100** does not include a sensor **110**, but rather includes a switch actuated by a user when requesting the dispensing an article of sheet material. The switch may include any of a variety of switches configured to close a circuit, including for example, a button. In another embodiment, apparatus **100** includes both sensor **110** and a switch.

In one embodiment, apparatus **100** may include, with or without sensor **110**, wireless networking capabilities, such

that apparatus **100** may be remotely activated via a Bluetooth connection, a Wi-Fi connection, a radio signal, a cellular signal, or the like.

FIGS. **2**A and **2**B illustrate an example arrangement of a dispensing apparatus **200**. Dispensing apparatus **200** may include a cover **202**, a rear wall **204**, and at least one side wall **206**. Dispensing apparatus **200** may include a sensor **210**.

Apparatus **200** may include at least one dispensing port **208**. Dispensing port **208** may be oriented in at least one side wall **206**. Dispensing port **208** may be configured and positioned to permit the passage of an article of a sheet material **212** to pass through dispensing port **208**.

Cover **202** may be selectively removable to allow one to access the interior of apparatus **200**. Cover **202** may be removably connected to rear wall **204** via any of a variety of mechanisms, including at least one of a hinge, a fastener, a friction fit, a sliding channel, clips, and the like. Cover **202** may be a door.

Rear wall **204** may be connected to a surface, such as a wall, a floor, a ceiling, another object, a post, and the like. Rear wall **204** may be permanently connected to a surface, or removably connected to a surface.

One or more sheet materials **212** may be contained within apparatus **200**. Sheet materials **212** may be oriented in a stack. Sheet materials **212** may be oriented in a stack on a card, wherein the card contains the sheet materials **212** in the stack, and may act as a substrate to attach sheet materials **212** to an interior surface of apparatus **200**. Sheet materials **212** may be attached to, or oriented near, rear wall **204**.

Apparatus **200** may include at least one supply roller **214**. Supply roller **214** may be configured to rotate. Supply roller **214** may be operatively connected to a motor (not shown). Supply roller **214** may be configured to contact at least one article of sheet material **212**. Supply roller **214** may contact at least one article of sheet material **212** while rotating, causing the at least one article of sheet material **212** to be dispensed through dispensing port **208**. Supply roller **214** may have an abrasive, soft, tacky, or otherwise increased friction exterior surface. Supply roller **214** may include a rubber coating **216** oriented about at least a portion of its exterior surface.

Supply roller **214** may have truncated cylinder shape, such that when supply roller **214** is oriented as illustrated in FIG. **2**A, it is not in contact with sheet material **212**. As such, supply roller **214** may have a radiused portion and a truncated portion. Rubber coating **216** may not extend completely about supply roller **214**, but rather, may only extend about that portion of supply roller that is radiused.

Supply roller **214** may be operatively connected to a rotation shaft **218**. Shaft **218** may be operatively connected to a motor (not shown). Supply roller **214** may be directly connected to shaft **218**. Shaft **218** may extend at least partially through supply roller **214**.

Apparatus **200** may include a retracting roller **220**. Retracting roller **220** may include a radiused portion and at least one flat, truncated portion. In one embodiment, retracting roller **220** includes a radiused portion, and three flat, truncated portions. Retracting roller **220** may be operatively connected to a motor (not shown). Retracting roller **220** may be configured to rotate. Retracting roller **220** may be configured to rotate with supply roller **214**. Retracting roller **220** may rotate directly with supply roller **214**, such that retracting roller **220** and supply roller **214** rotate the same amount as one another, for example, 360 degrees.

Retracting roller **220** may be operatively connected to a rotation shaft **218**. Shaft **218** may be operatively connected to a motor (not shown). Retracting roller **220** may be directly connected to shaft **218**. Shaft **218** may extend at least partially through retracting roller **220**.

Retracting roller **220** may include a radiused portion that is directed in a first direction, while supply roller **214** may have a radiused portion that is directed in a second direction, and the first and second directions may be opposite one another (about 180 degrees from one another).

Apparatus **200** may include a mounting plate **222**. Mounting plate **222** may include one or more substantially planar portions separated by bends. Mounting plate **222** may be connected to an interior of cover **202**, rear wall **204**, or side wall **206**. Mounting plate **222** may be connected to an interior of apparatus **200** by any of a variety of mechanisms, including for example a fastener **224**. Mounting plate **222** may be connected to a fixing plate **226**, which may be connected to an interior of apparatus **200**, including for example, an interior surface of cover **202**. Mounting plate **222** may be connected to fixing plate **226** via fastener **224**. Fastener **224** may include any of a variety of fasteners. Fastener **224** may include a shaft forming a hinge. Mounting plate **222** may be hingedly connected to fixing plate **226**. Fastener **224** may be a fixing shaft.

Mounting plate **222** may be operatively connected to at least one of supply roller **214**, retracting roller **220**, and shaft **218**. Mounting plate **222** may be connected to supply roller **214**, retracting roller **220**, and shaft **218**.

Mounting plate **222** may be additionally connected to cover **202** via at least one supporting tab **228**. Supporting tabs **228** may act as struts to support mounting plate **222**. In one embodiment, mounting plate **222** may deflect during dispensing of sheet material **212**. Mounting plate **222** may bend about at least one supporting tab **228**.

Mounting plate **222** may include an electronics box **230**. Electronics box **230** may contain at least some of the electronics of apparatus **200**. Electronics box **230** may include for example a power source, such as a battery or a direct connection to electricity running through a building. Electronics box **230** may also include at least one printed circuit board. Electronics box **230** may include at least one programmable controller chip. Electronics box **230** may include circuitry and other wiring necessary for the operation of apparatus **200**. For example, sensor **210** may be in electrical communication with electronics box **230**. As another example, a motor (not shown) may be in electrical communication with electronics box **230**. A power source may include at least one of: a battery, electricity from wall receptacle, electricity from a generator, a solar panel, a photo panel, and the like.

In one embodiment, electronics box **230** includes a programmable controller chip. The programmable controller chip may be programmed to allow at least one of: the adjustment of the period of time for which the motor (illustrated in FIG. **3** at **340**) is operated to discharge one piece of sheet material **212**; the indication of a low accumulator or battery charge level by giving a light and/or audio signal; the recognition of the appropriate sheet material **212** (e.g., proprietary material); the connection of a coin recognition system; the storage and playback of promotional and awareness raising audio materials.

In one embodiment, a power source is located within dispenser **200**, but outside of electronics box **230**. The power source may be a battery oriented within dispenser **200** near mounting plate **222**, but outside of electronics box **230**.

Electronics box **230** may include a counter (not shown) configured to count the number of dispenses of sheet material **212**. Electronics box **230** may include a counter (not

shown) configured to count the number of dispenses of sheet material **212** and alert a user when dispenser **200** is out of sheet material **212**. Electronics box **230** may include a counter (not shown) configured to count the number of dispenses of sheet material **212** and alert a user when dispenser **200** is almost out of sheet material **212** and has dispensed an amount specified. For example, a user may desired to be alerted when 10% or less of sheet material **212** is remaining in dispenser **200**. Thus, electronics box **230** may alert a user when 90% of sheet material **212** has been dispensed.

In one embodiment, dispenser **200** includes an aperture (not shown) in cover **202**, which may allow a user to visually inspect the quantity of sheet material **212** remaining in dispenser **200**. In one embodiment, a sheet material card (not shown) may be colored with a color significantly contrasting with the color of sheet material **212**. A user may visually inspect and recognize the color of the sheet material card, thus knowing that dispenser **200** is empty. Alternatively, rear wall **204** may include a color significantly contrasting with the color of sheet material **212**.

In one embodiment, dispenser **200** includes a light or other signal that is activated upon the dispensing of all of sheet material **212**, or a specified quantity of sheet material **212** (e.g., 90%).

In one embodiment, electronics box **230** may include a reset button, which reset button may indicator that a full stack of sheet material **212** has been inserted into dispenser **200**, after which electronics box **230** may start over its counting of the number of sheet materials **212** dispensed.

Mounting plate **222** comprising a biasing material, which when bent, may provide a force against bending in an attempt to be straight. Mounting plate **222** may comprise a spring steel, polymer, organic material, laminated material, alloy, composite, or the like.

Stated differently, when mounting plate **222** is deflected due to contact between supply roller **214** and sheet material **212**, mounting plate **222** may provide a bias against this deflection, providing a force to keep supply roller **214** in contact with sheet material **212**. When mounting plate **222** is deflected due to contact between retracting roller **220** and a supporting plate **232** connected to an interior surface of apparatus **200**, mounting plate **222** may provide a bias against this deflection, providing a force to keep retracting roller **220** in contact with supporting plate **232**. Mounting plate **222** may be flexible.

Supporting plate **232** may at least partially circumvent retracting roller **220**. Supporting plate **232** may be operatively connected to apparatus **200**. Supporting plate may be operatively connected to an interior surface of cover **202**. Supporting plate may be connected to an interior surface of cover **202**. Supporting plate may be connected to any interior surface of apparatus **200**.

Retracting roller **220** may engage supporting plate **232** at some point during the rotation of retracting roller **220**. Retracting roller **220** may be configured to engage supporting plate **232** to limit the translation of supply roller **214** toward sheet material **212**.

As illustrated in FIG. **2**B, a dispensed sheet **234** may be advanced through dispensing port **208**.

Dispenser **200** may include a code reader **233**. Code reader **233** may be configured to read a proprietary code located on one or more of sheet material **212**, a sheet material card (not shown), or the like. In one embodiment, code reader **233** seeks a proprietary code located on one or more of sheet material **212**, a sheet material card (not shown), or the like. If code reader **233** cannot locate the necessary proprietary code, dispenser **200** may be deactivated to prevent damage, jamming, or other difficulties caused by the dispensing of non-proprietary sheet material **212**.

Code reader **233** may be an RFID reader, where sheet material **212** or a sheet material card (not shown) includes a proprietary RFID tag.

Code reader **233** may be a magnetic sensing system. The magnetic sensing system code reader **233** may sense and/or read a magnetic strip oriented on sheet material **212** or a sheet material card (not shown). The magnetic strip may include proprietary codes to prevent use of non-proprietary sheet material **212**. The magnetic strip may be printed on sheet material **212** or a sheet material card. The magnetic strip may be adhered to sheet material **212** or a sheet material card.

Code reader **233** may include any reader, existing or to be developed in the future, that may communicate with sheet material **212** or a sheet material card to ensure that proprietary material is being dispensed from dispenser **200**.

Code reader **233** may be a bar code reader, where sheet material **212** or a sheet material card (not shown) includes a proprietary bar code.

FIG. **3** illustrates an example arrangement of a dispensing apparatus. The apparatus may include a fixing plate **326**, a fastener **324**, a mounting plate **322**, at least one supporting tab **328**, an electronics box **330**, a supporting plate **332**, a retracting roller **320**, a supply roller **314**, the supply roller **314** having a rubber coating **316**, and a shaft **318** operatively connected to the retracting roller **320**, and the supply roller **314**.

A motor **340** may be operatively connected to shaft **318**. Motor **340** may cause shaft **318** to rotate, which may in turn cause retracting roller **320** and supply roller **314** to rotate. As retracting roller **320** rotates, it may disengage supporting plate **332**, which may allow supply roller **314** to contact a sheet material (e.g., sheet material **212**). As supply roller **314** rotates, it may pull a single article of the sheet material from its stack and cause it to advance from the apparatus. As supply roller **314** continues to rotate, retracting roller **320** may engage supporting plate **332**, causing supply roller **314** to retract away from the stack of sheet material, and thus allowing a user to withdraw the article of sheet material from the apparatus without restriction.

Motor **340** may be an electric motor powered by a battery oriented within the apparatus. Motor **340** may be an electric motor powered by an electrical source exterior to the apparatus.

An aperture may be formed in mounting plate **322** for the supply roller **314**. The aperture may allow supply roller **314** to extend beyond the plane of mounting plate **322** during supply roller **314**'s movement.

In one embodiment, a microswitch **331** is fixed on mounting plate **322**, at the side toward supply roller **314**. A microswitch activating cam **333** may extend from a side of supply roller **314**. Microswitch activating cam **333** may contact microswitch **331**, causing motor **340** to stop while supply roller **314** is in a retracted position. Microswitch **331** may ensure that motor **340** only complete one single revolution (about 360 degrees) upon each activation of motor **340**.

FIG. **4** illustrates example arrangement of a sheet material card containing multiple sheets **412**. The sheet material card may include a plurality of sheets **412** stacked on top of one another. Sheets **412** may be folded, such that the dispenser apparatus would dispense a folded sheet, and the user would unfold the sheet prior to use. Sheets **412** may not be folded.

Sheets **412** may be mounted directly to a substrate **444**. Substrate **444** may include at least one sheet mounting aperture **446** configured to engage at least a portion of a dispensing apparatus (e.g., rear wall **204** illustrated in FIGS. **2**A and **2**B).

In one embodiment, sheets **412** are connected to substrate **444** via a perforated connection that is configured to break upon application of force from a supply roller. In another embodiment, sheets **412** are connected to substrate **444** via a limited connection that is configured to break upon application of force from a supply roller. In this manner, sheets **412** may be removed from substrate **444** without tearing sheet **412** in its main body. Sheets **412** may be connected to substrate **444** via staples, which may permit sheet **412** to be easily torn from substrate **444**. Sheets **412** may be connected to substrate **444** via an adhesive or glue, which may permit sheet **412** to be easily torn from substrate **444**.

The sheet material card may include a coded element **447**. Coded element **447** may be oriented on substrate **444**. Coded element **447** may be oriented on sheets **412**. Coded element **447** may include a proprietary RFID tag. Coded element **447** may include a proprietary bar code.

FIGS. **5**A-**5**J illustrate an example arrangement of a retracting roller **520**, a sheet supply roller **514**, and a sheet material **512**. Supply roller **514** may include a rubber coating **516**. Supply roller **514** and retracting roller **520** may be connected to a shaft **518**.

Retracting roller may engage a supporting plate **532**. Supporting plate **532** is illustrated simply in FIGS. **5**A-**5**J to avoid the illustration of supporting plate **532** interfering with the view of retracting roller **520** and supply roller **514**. It is understood, however, that the portion of supporting plate **532** illustrated in FIGS. **5**A-**5**J may be the only portion of supporting plate **532** that retracting roller **520** engages during operation of the dispensing apparatus.

Sheet material **512** may be oriented in a stack. Sheet material **512** may be attached to a substrate **544**. Sheet material **512** may be connected to substrate **544** via a limited connection **548** configured to break, tear, or otherwise disconnect upon application of a force upon a single sheet **512** by supply roller **514**.

As illustrated in FIG. **5**A, the radiused portion of supply roller **514** is oriented away from sheet material **512** between dispensing of articles of sheet material **512**. The radiused portion of the retracting roller **520** is oriented toward sheet material **512** between dispensing of articles of sheet material **512**.

Upon initiation of a dispensing operation, supply roller **514** and retracting roller **520** rotate clockwise (see FIG. **5**B). FIGS. **5**C-**5**G illustrate supply roller **514** contacting and dispensing a dispensed sheet **534**, while retracting roller **520** is rotated such that its radiused portion is out of contact with supporting plate **532**. As a result of retracting roller **520** rotating out of contact with supporting plate **532**, supply roller **514** is permitted to be translated into contact with sheet material **512** due to biasing of mounting plate (**222** in FIGS. **2**A and **2**B). [**0081**] FIG. **5**H illustrates the radiused portion of retracting roller **520** again contacting supporting plate **532**, causing supply roller **514** (and mounting plate **222**) to move away from sheet material **512**. As illustrated, supply roller **514** is removed from contact with sheet material **512** upon the radiused portion of retracting roller **520** contacting support plate **532**.

FIGS. **5**I and **5**J illustrate supply roller **514** (and mounting plate **222**) being forced to move further from sheet material **512**. As a result, a user is able to draw dispensed sheet **534** from the apparatus, without any portion of dispensed sheet **534** engaging, snagging on, or otherwise contacting, any portion of the dispensing mechanism (retracting roller **520**, supply roller **514**, and mounting plate **222**). In this manner, a user is able to remove dispensed sheet **534** without tearing it. In this manner, the dispenser is unlikely to jam, as the use of retracting roller **520** and supply roller **514**, as described herein, provided surprising results in the reliability of the dispensing apparatus.

As illustrated, during dispensing of a single sheet material **512**, supply roller **514** and retracting roller **520** may rotate about 360 degrees. In another embodiment, during dispensing of a single sheet material **512**, supply roller **514** and retracting roller **520** may rotate more than about 360 degrees. In another embodiment, during dispensing of a single sheet material **512**, supply roller **514** and retracting roller **520** may rotate less than about 360 degrees.

FIG. **6** illustrates a retracting roller **620**. Retracting roller **620** may include a radiused portion **651** and at least one truncated portion **652**, **654**. In one embodiment, retracting roller **620** includes two side truncated portions **652**, and one rear truncated portion **654**, rear truncated portion **654** being opposite radiused portion **651**, and side truncated portions **652** being oriented between rear truncated portion **654** and radiused portion **651**. Retracting roller **620** may include a shaft aperture **656** configured to accept a shaft, such as shaft **218**, **318**, **518**.

FIG. **7** illustrates a retracting roller **720**. As illustrated, retracting roller **720** may include a radiused portion having a radius R**1**. Retracting roller **720** may include side truncated portions having a radius R**2**. Retracting roller **720** may include rear corner portions having a radius R**3**. Retracting roller **720** may include a rear truncated portion having a radius R**4**. The value of R**1** may be greater than the value of R**2**, R**3**, and R**4**. R**3** may be greater than R**2** and R**4**, but lesser than R**1**. R**2** may be about equal to R**4**.

Retracting roller **720** may have an isosceles trapezoid-shaped cross-section, except that the longer base of the isosceles trapezoid has a curved, radiused portion (e.g., **651**).

FIG. **8** illustrates a sheet supply roller **814**. Supply roller **814** may include a rubber coating **816** covering its radiused portion. Supply roller **814** may include a truncated portion **862**. Supply roller **814** may include a shaft aperture **860** configured to accept a shaft, such as shaft **218**, **318**, **518**. The radiused portion of supply roller **814** may have a radius R**1**. Truncated portion **862** may have a radius R**2**. The value of radius R**1** may be greater than the value of R**2**.

In one embodiment, supply roller **814** about 70% of a complete cylinder, the 30% being removed to form the truncated cylinder.

To the extent that the term "includes" or "including" is used in the specification or the claims, it is intended to be inclusive in a manner similar to the term "comprising" as that term is interpreted when employed as a transitional word in a claim. Furthermore, to the extent that the term "or" is employed (e.g., A or B) it is intended to mean "A or B or both." When the applicants intend to indicate "only A or B but not both" then the term "only A or B but not both" will be employed. Thus, use of the term "or" herein is the inclusive, and not the exclusive use. See Bryan A. Garner, A Dictionary of Modern Legal Usage 624 (2d. Ed. 1995). Also, to the extent that the terms "in" or "into" are used in the specification or the claims, it is intended to additionally mean "on" or "onto." To the extent that the term "selectively" is used in the specification or the claims, it is intended to refer to a condition of a component wherein a user of the apparatus may activate or deactivate the feature

or function of the component as is necessary or desired in use of the apparatus. To the extent that the term "operatively connected" is used in the specification or the claims, it is intended to mean that the identified components are connected in a way to perform a designated function. To the extent that the term "substantially" is used in the specification or the claims, it is intended to mean that the identified components have the relation or qualities indicated with degree of error as would be acceptable in the subject industry. As used in the specification and the claims, the singular forms "a," "an," and "the" include the plural. Finally, where the term "about" is used in conjunction with a number, it is intended to include ±10% of the number. In other words, "about 10" may mean from **9** to **11**.

As further illustrated in FIG. **9**, the electronics box **203** includes a controller **900** including a processor **902** and a memory **904**. The memory **904** is configured to store program instructions and the processor **902** is configured to execute the stored program instructions in response to transmitted signals received from the user sensor **110** and a magnet sensor **906**. In one embodiment, the magnet sensor is the magnetic sensing system code reader **233**. In another embodiment, the magnet sensor **906** is configured to detect the presence or absence of a magnet **908**, which is located in the sheet material card **412** of FIG. **4**. In addition, the controller **900** is operatively connected to the motor **340**, as described herein, to dispense a sheet of material as described herein.

The controller **900**, in different embodiments, includes a computer, computer system, or other programmable devices. In other embodiments, the controller **900** includes one or more processors (e.g. microprocessors or programmable controller chips), and an associated memory, which can be internal to the processor of external to the processor. The memory **904** can include random access memory (RAM) devices comprising the memory storage of the controller **900**, as well as any other types of memory, e.g., cache memories, non-volatile or backup memories, programmable memories, or flash memories, and read-only memories. In addition, the memory, in different embodiments, includes a memory storage physically located elsewhere from the processing devices and any cache memory in a processing device, as well as any storage capacity used as a virtual memory, e.g., as stored on a mass storage device or another computer coupled to the controller. The mass storage device can include a cache or other dataspace which can include databases. Memory storage, in other embodiments, is located in the "cloud", where the memory is located at a distant location which provides the stored information wirelessly to the controller **900**.

A power supply **910** provides a source of power to the electronics box **230** and to the motor **340**. In different embodiments, the power supply **910** includes one more batteries or is a direct connection to electricity running through a building.

The controller **900** executes or otherwise relies upon computer software applications, components, programs, objects, modules, or data structures, etc. Software routines resident in the included memory of the controller or other memory are executed in response to the signals received. The computer software applications, in other embodiments, are located in the cloud. The executed software includes one or more specific applications, components, programs, objects, modules or sequences of instructions typically referred to as "program code". The program code includes one or more instructions located in memory and other storage devices which execute the instructions which are resident in memory, which are responsive to other instructions generated by the system, or which are provided a user interface operated by the user. The controller is configured to execute the stored program instructions.

While each of the different components of the system **110** are shown being coupled to a single controller **900**, other configurations are contemplated. For instance in one embodiment, the magnet sensor **906**, the reset button **914**, and the reset light **916** are located on a first circuit board while the remaining components are located on a second circuit board. Consequently, the embodiment of FIG. **9** is not considered to be limiting and other arrangements of components and circuit boards are considered to be within the scope of the present disclosure.

As illustrated in FIG. **9**, the user sensor **110** is operatively connected to the electronics box **230** and to the processor **902**. An indicator **912** is also coupled to the controller **902** and provides one or more status indications to a user of the apparatus **100**, such as further described with respect to FIG. **10**. In one embodiment, the indicator **912** is a ring light, or circle light, that surrounds a window **918** as is illustrated in FIG. **11**. In different embodiments, the window is one of transparent, opaque, or translucent window. In other embodiments, the window **918** is not included. In different embodiments, the indicator **912** is a light emitting diode, an incandescent light, or a halogen light. Other type of lights are contemplated.

FIG. **10** is a process diagram **928** illustrating one or more operating procedures of the apparatus **100**. In block **930**, the user sensor **110**, which is in a detection mode when powered by the power supply **910**, is activated by a user by waving a hand or other object. Once triggered, the processor **900** detects the activation, an object sensing event, at block **930** and in response, rotates the motor shaft to dispense one of the sheets of material from the sheet material card **412** as described herein. At the same time, the processor **900** transmits a signal to the indicator **912**, i.e. a light, at block **932**. The light is illuminated to notify the user that the sensor **110** has detected the presence of the user. Once the motor shaft has rotated a predetermined distance, the cam **333** engages the switch **331**. When the switch changes states, the change being determined by the controller **900**, the controller **900** turns off the motor **340** to prevent further dispensing of the sheet. In addition to turning off the motor **340**, the controller **900** changes a sheet count stored in a counter, which in one embodiment is located in the memory **904** as illustrated at block **934**.

The counter is either incremented or decremented depending on how the processor **900** is programmed. In one embodiment, the counter is set to a maximum value representing a number of sheets, for instance 100 sheets, and the value is reduced by one each time the motor **340** turns one revolution as determined by the switch **331**. When the count reaches zero, the processor sets a flag to indicate that the card **412** needs replacement. In another embodiment, the counter is initially set to zero and the count is increased until the count reaches a maximum value. For instance, if the card **412** typically includes 105 sheets, the maximum value could be set to 100. A predetermined threshold value of 100 is set, and when the count reaches 100, the processor **900** sets a flag to indicate the card needs replacement.

While revolutions of the motor shaft are used to determine sheet count, other mechanisms to count sheets are contemplated. For instance in one embodiment, a monitoring device monitors a thickness of the sheets remaining in the card and when the card is sufficiently thin, the monitoring device transmits a signal to the processor **900** to indicate that the

card should be replaced. In other embodiments, a direct counting of sheets is contemplated where a leading edge or trailing edge of a sheet is identified by a sensor that transmits to the processor **900** a signal indicating that a sheet has been dispensed.

Once the motor shaft has dispensed the sheet, the processor **900** delays activation of the motor in response to the user sensor **110** for a predetermined period of time. In one embodiment the period of time for delay is 10 seconds, however, other periods of time are contemplated. In different embodiments, the processor **900** includes a programmable delay which enables a user, a maintenance person, or an installer of the apparatus **100** to set the delay time.

Assuming that a sufficient number of motor rotations have occurred, the controller **900** determines that the card **412** should be replaced. Upon making this determination, the indicator **912** is alternately turned on and off by the processor to indicate the lack of sheets at block **938**. If it is determined by the user that the indicator **912** is flashing, the process proceeds to block **940**. If, however, the indicator **912** is not flashing, the process returns to block **930** to wait for an activation of the sensor at block **930**.

If the light indicates that a new card should be placed in the apparatus **100**, the user or a maintenance person opens the cover **202**, or door, at block **940**, and inserts a card **412**, i.e. sheet refill, into the apparatus **100** at block **942**. To indicate that a new card **412** has been inserted, the installer of the card **412** presses the reset button **916** at block **944**. Upon a pressing of the reset button **944**, the processor **900** transmits a signal to the reset light **916** to illuminate the light for a predetermined period of time of 3 seconds at block **946**. Other periods of time are contemplated and can be stored into the memory **904** to control the duration of illumination of the reset light **916**. The counter is also reset by the processor to indicate that the apparatus has been refilled with a new card of sheet at block **948**. In other embodiments, the reset button **916** is not pressed manually, but the closing of the door automatically presses a button to provide the reset of the counter.

Once the reset button is pushed, the cover **202** is closed at block **950**. After closing, the magnet **908** of the card **412** is sensed by the magnet sensor **906** and the magnet sensor transmits a signal to the processor **900**. The processor **900**, in response to this signal, prevents activation of the motor **340** for a predetermined period of time, i.e. 30 seconds, at block **952**. Other periods of time are contemplated and in different embodiments, the period of time is programmable.

The processor **900** is also programmed to determine the state of or power level provided by the power supply **910**. In the case where the power supply is a battery supply, the processor **900** determines whether the power supplied by the batteries is too low when compared to a threshold value. In other embodiments, the power level detector is separate from the processor. If the battery power is acceptable as determined at block **954**, the light **912** is not turned on continuously and the processor continues to determine the state of the sensor **110** at block **930**. If however, the battery power is too low (not acceptable), then the processor illuminates the light **912** continuously to indicate that the batteries should be replaced at block **956**. Once the batteries are replaced, the processor **900** determines that the battery power is acceptable and prevents activation of the motor **340** for a period of 30 seconds after replacing the batteries. After the batteries are replaced and the delay has transpired, the apparatus **100** returns to block **930** to provide sheets.

While the process diagram **928** illustrates a certain order of steps, the present disclosure is not limited to the illustrated order of steps and other orders of steps are contemplated and do occur. For instance, step **954** is shown to occur after preventing activation of the motor for 30 seconds and after a reset to the sheet counter. The processor **900** in one embodiment, however, monitors battery power continuously during the entire sheet dispensing procedure. Consequently, the continuous illumination of the light **912** occurs at any time when power supplied by the power supply **910** is insufficient and not only after step **952**. Likewise in different embodiments, the processor **900** monitors the counting of sheets continuously and a flashing of the light at block **938** occurs at different times during the process. For instance, in one embodiment, continuous illumination of the light **912** takes precedence over a flashing illumination of the light, such that once the batteries are replaced, the light flashes to indicate that the sheet card is empty. In other embodiments, detection of the number of sheets and the power supplied by the batteries occur at predetermined periods of times, for instance every minute, as interrogated by the processor **900**.

Different features are indicated by different light illumination patterns. For instance, the light flashes to indicate that the card **412** should be changed and the light is illuminated continuously to indicate that the power supply is not supplying sufficient power. In other embodiments, however, the illuminations patterns are reversed such that flashing lights indicate that the power is low and continuous illumination indicates that the card should be changed. Consequently, while different patterns of lights are described as signifying different conditions of the sheet dispensing apparatus, other patterns of illumination are contemplated.

In another embodiment, and as further illustrated in FIGS. **11** and **12**, the window **918** includes a metallic disk **960** that cooperates with a capacitive sensor **962** (see FIG. **12**), which is electrically coupled to a printed circuit board **964**. The indicator **912** circumscribes the metallic disk **960**, which in one embodiment is a stainless steel disk. Other materials for the metallic disk **960** are contemplated. The interaction between the metallic disk **960** and the sensor **962** determines the presence of an individual, such as a waving of a hand. The printed circuit board **964** is fixedly coupled to the cover **202** at a plurality of bosses where FIG. **12** illustrates a first boss **966** and a second boss **968**. In one embodiment, the bosses **966** and **968** are made as part of the cover **202** during an injection molding process. In the illustrated embodiment, the window **918** is generally located at the center of the cover **202**. Other locations are contemplated.

An electronics box **970**, in different embodiments, includes at least one printed circuit board. Electronics box **970** may include at least one programmable controller chip. Electronics box **970** may include circuitry and other wiring necessary for the operation of apparatus **200**. For example, sensor **962**, in one embodiment, is in electrical communication with electronics box **970**. As another example, a motor (not shown) may be in electrical communication with electronics box **970**. A power source (not shown), in different embodiments, includes at least one of: a battery, electricity from wall receptacle, electricity from a generator, a solar panel, a photo panel, and the like for powering the electrical components. While the electronics box **970** is illustrated at a position toward an upper portion of the apparatus **200**, other locations are contemplated.

As stated above, while the present application has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily

appear to those skilled in the art, having the benefit of the present application. Therefore, the application, in its broader aspects, is not limited to the specific details, illustrative examples shown, or any apparatus referred to. Departures may be made from such details, examples, and apparatuses without departing from the spirit or scope of the general inventive concept.

What is claimed is:

1. A method for dispensing with a sheet dispenser a sheet from a plurality of sheets, the method comprising:

detecting a plurality of object sensing events with an object sensor;

for each object sensing event, moving a supply roller into contact with a sheet of the plurality of sheets and rotating a motor shaft to dispense the sheet with the supply roller;

for each rotation of the motor shaft, updating a value stored in a counter to indicate the number of sheets being dispensed from the plurality of sheets;

comparing the stored value to a predetermined value; and

illuminating a light to emit a first pattern when the stored number reaches the predetermined value, wherein the light illumination provides an indication that the sheet dispenser requires additional sheets for dispensing; wherein for each object sensing event, not rotating the motor shaft in response to a second object sensing event when a first object sensing event is followed by the second object sensing event within a predetermined amount of time.

2. The method of claim **1** wherein the predetermined amount of time is about 10 seconds or less.

3. The method of claim **1** further comprising setting the stored value to a different value in response to a reset button being activated.

4. The method of claim **3** further comprising detecting a power level of a power supply.

5. The method of claim **4** further comprising illuminating the light to emit a second pattern when the detected power level of the power supply is less than a predetermined value.

6. The method of claim **5** wherein the first pattern is one of a flashing pattern and a continuous pattern and the second pattern is the other of the flashing pattern and the continuous pattern.

7. A sheet dispensing apparatus including a wall configured to support a sheet material card having a plurality sheets, the apparatus comprising:

an object sensor configured to dispense a sheet from the sheet material card in response to activation by a user;

a supply roller connected to a shaft, wherein the supply roller has a radiused portion and at least one truncated portion;

a retracting roller connected to the shaft, wherein the retracting roller has a radiused portion, and at least one truncated portion;

a supporting plate engaged and disengaged by the retracting roller during rotation of the shaft;

wherein, the radiused portion of the supply roller is directed in a first direction and the radiused portion of the retracting roller is directed in a second direction, the first direction being different from the second direction, wherein, the object sensor is operatively connected to the shaft through a processor and activates disengagement of the retracting roller from the supporting plate and activates the supply roller to translate toward the wall of the sheet dispensing apparatus for dispensing a sheet from the sheet material card.

8. The sheet dispensing apparatus of claim **7** further comprising a counter having a count, wherein the counter prevents disengagement of the retracting roller and activation of the supply roller in response to activation of the object sensor based on the count of the counter.

9. The sheet dispensing apparatus of claim **8** wherein the count of the counter is about 10 seconds.

10. The sheet dispensing apparatus of claim **8** further comprising a motor, operatively connected to the shaft, and a power supply operatively connected to the motor, wherein the power supply provides power for operation of the motor.

11. The sheet dispensing apparatus of claim **10** further comprising a power level detector operatively connected to the power supply, wherein the power level detector determines the power level of the power supply.

12. The sheet dispensing apparatus of claim **11** further comprising an indicator operatively connected to the processor, wherein the processor is configured to provide a status indication to the indicator in response to the determined power level provided by the power level detector.

13. The sheet dispensing apparatus of claim **12** further comprising a reset button operatively connected to the processor, wherein the reset button reset the count of the counter.

14. The sheet dispensing apparatus of claim **13** further comprising a magnet sensor spaced from the wall, wherein the magnet sensor is configured to detect the presence of a magnet located on the sheet material card.

15. A sheet dispensing apparatus including a wall configured to support a sheet material card having a plurality sheets, the apparatus comprising:

a sensor;

a motor including a motor shaft;

a supply roller operatively connected to the motor;

an indicator; and

a controller operatively connected to the sensor and to the indicator, the controller including a processor and a memory configured to store program instructions and the processor is configured to execute the stored program instructions to:

detect a first presence of an object with the sensor;

move the supply roller into contact with one sheet of the plurality of sheets in response to the detecting the first presence of the object;

rotate the motor shaft a first time to move the supply roller a predetermined angle of rotation to dispense the one sheet; and

stop the motor shaft when the predetermined angle of rotation has been completed;

wherein the processor is further configured to execute the stored program instruction to:

detect a second presence of an object with the sensor; and

not rotate the motor shaft a second time if the detect the second presence occurs within a predetermined period of time of the detect the first presence of an object; and

further comprising a switch operatively connected to the processor and wherein the processor is further configured to execute the stored program instruction to:

stop the motor shaft in response to contact with the switch during rotation of the motor shaft.

16. The sheet dispensing apparatus of claim **15** further comprising a cam operatively connected to the motor shaft and configured to contact the switch during rotation of the motor shaft, wherein the processor is further configured to execute the stored program instruction to:

count the number of times the cam contacts the switch; and

activate the indicator when the count indicates that sheet material card requires replacement.

17. The sheet dispensing apparatus of claim **16** further comprising a power supply to supply power and operatively connected to the controller, wherein the processor is further configured to execute the stored program instructions to:

determine when the power supplied by the power supply is insufficient to operate the motor.

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